Compressed Air Magazine

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AUGUST, 1928

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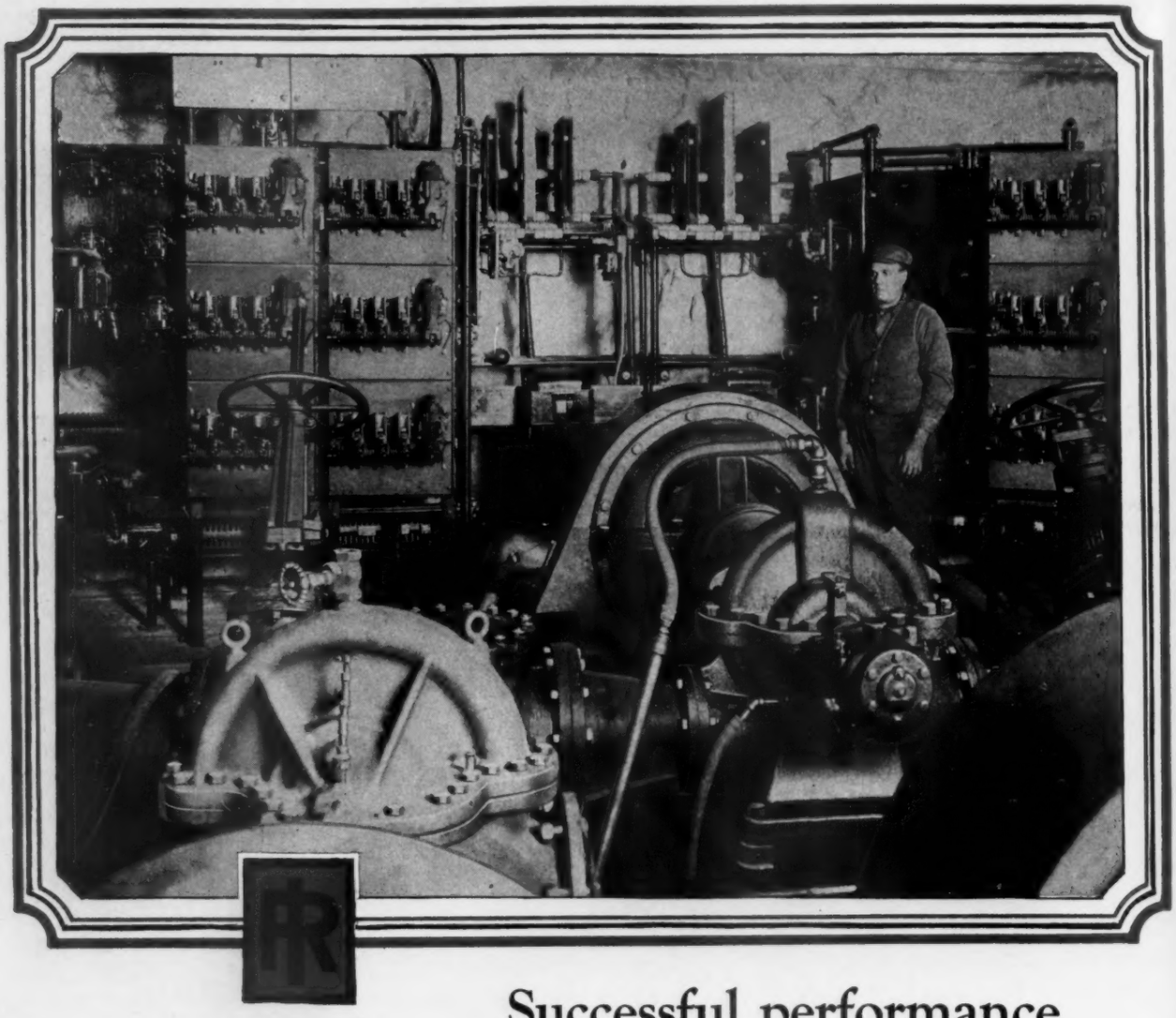

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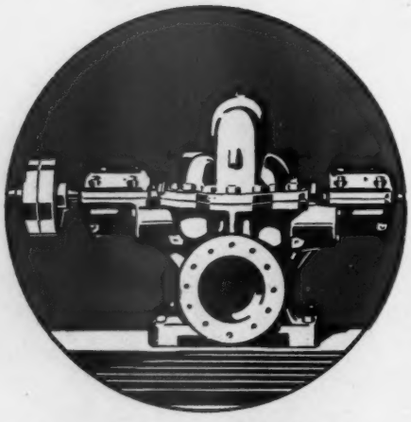

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This is a high head, single stage, centrifugal pump with a rated capacity of 4500 G.P.M. against a total discharge head of 304 ft.

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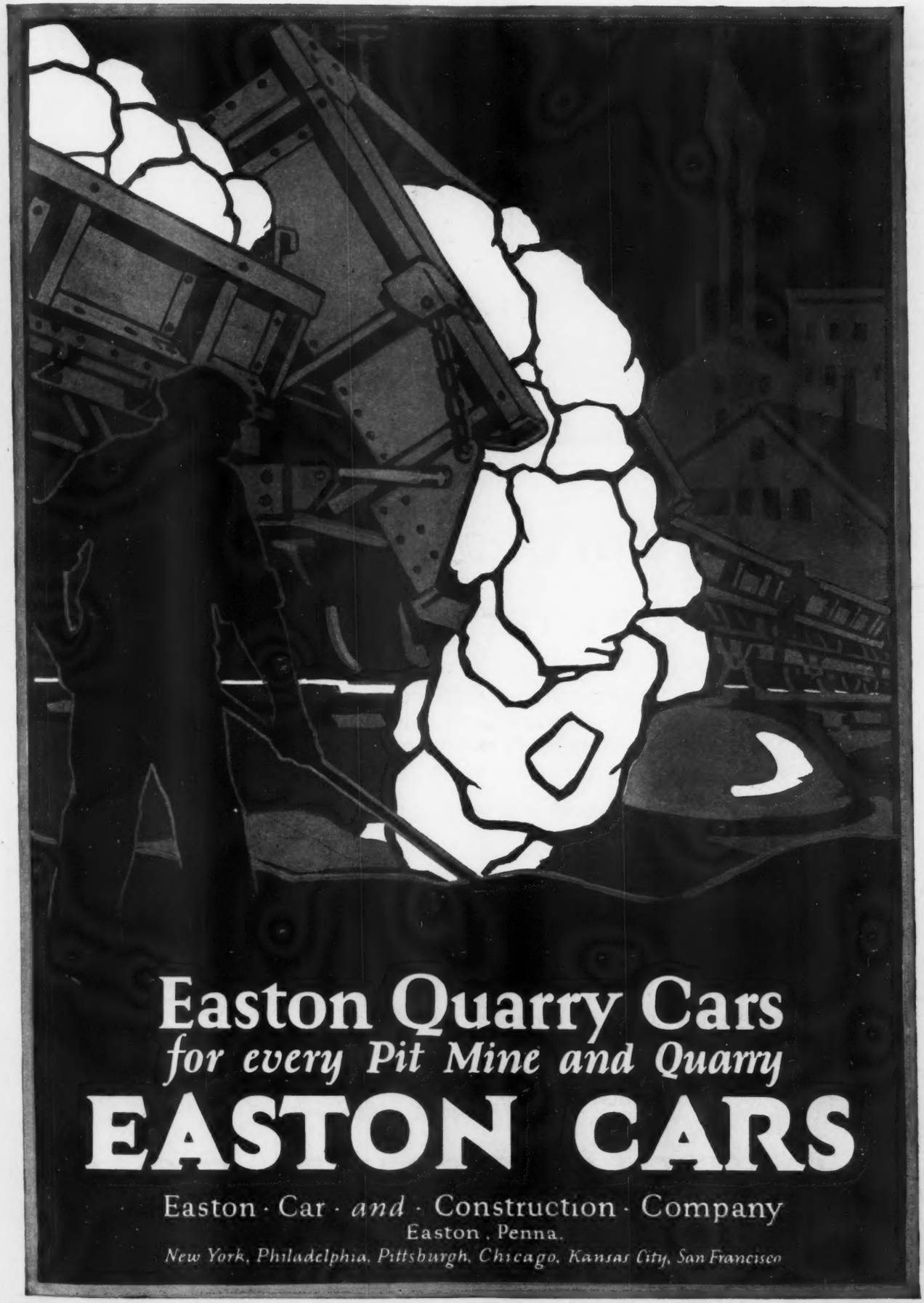
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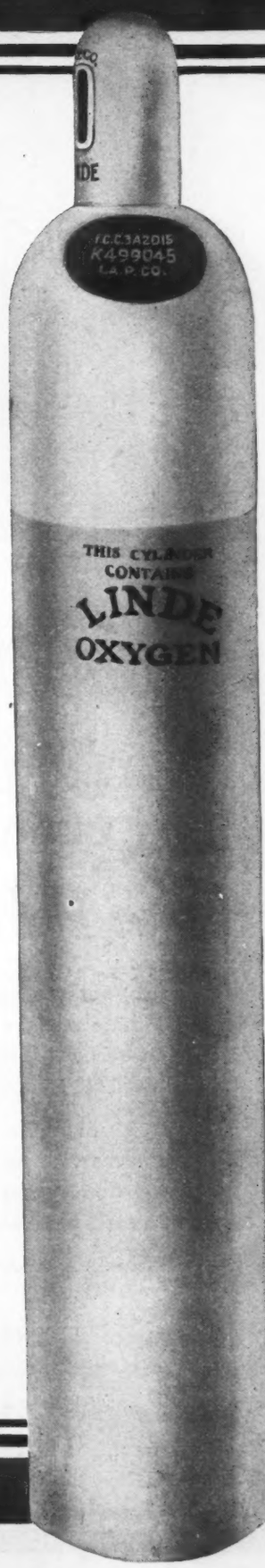

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THE GROUND is swampy and uneven at Sparkill, N. Y. where this 12 inch oil line was laid. Uneven settling of the line could be normally expected. So Victaulic Couplings were selected for the installation. They provide flexibility at every joint.

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Victaulic Couplings assure flexibility and remain leak-proof under severe vibration, line sag, pressure shocks or shifting the line sideways under full pressure load.

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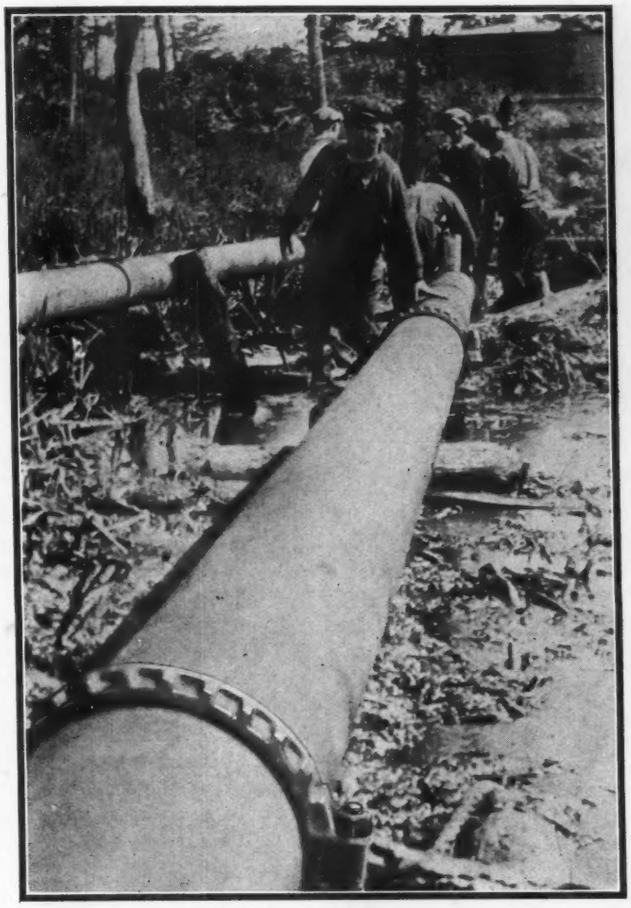
Victaulic Couplings save time, labor and money on every mile of pipe laid because it takes unskilled labor less than two minutes to install a Victaulic Coupling.



12" oil line through swamp.

The coupling cannot go together wrongly.

Pipe costs and pipe transportation costs are less when Victaulic Couplings are specified.

Victaulic Couplings are supplied for all pipe sizes from ¾ inch up, for steel, wrought iron and cast iron pipe, for all pressures from vacuum to 10 tons pressure per square inch. Victaulic Fittings make it easy to connect a Victaulic-coupled line with any existing line.

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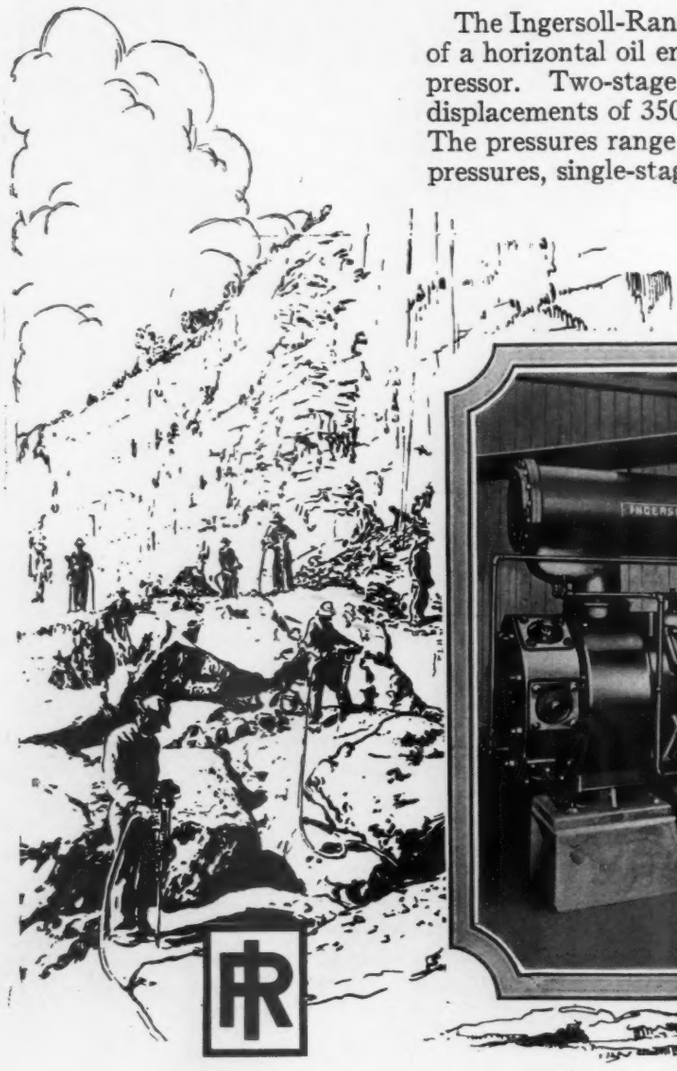
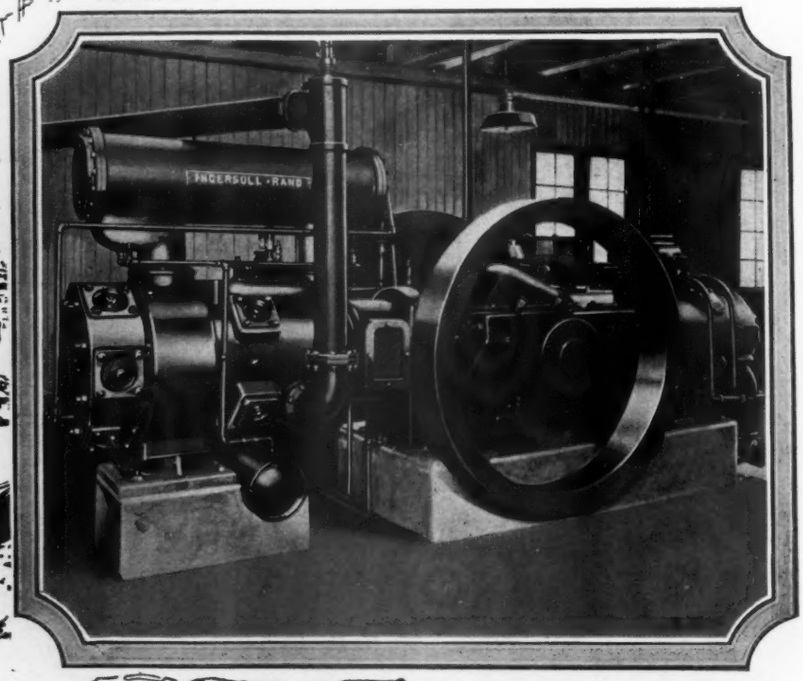


The Ingersoll-Rand Oil Engine Air Compressor consists of a horizontal oil engine direct-connected to an air compressor. Two-stage units are built in sizes with piston displacements of 350, 600, and 900 cubic feet per minute. The pressures range from 100 to 125 pounds. For lower pressures, single-stage machines are used.



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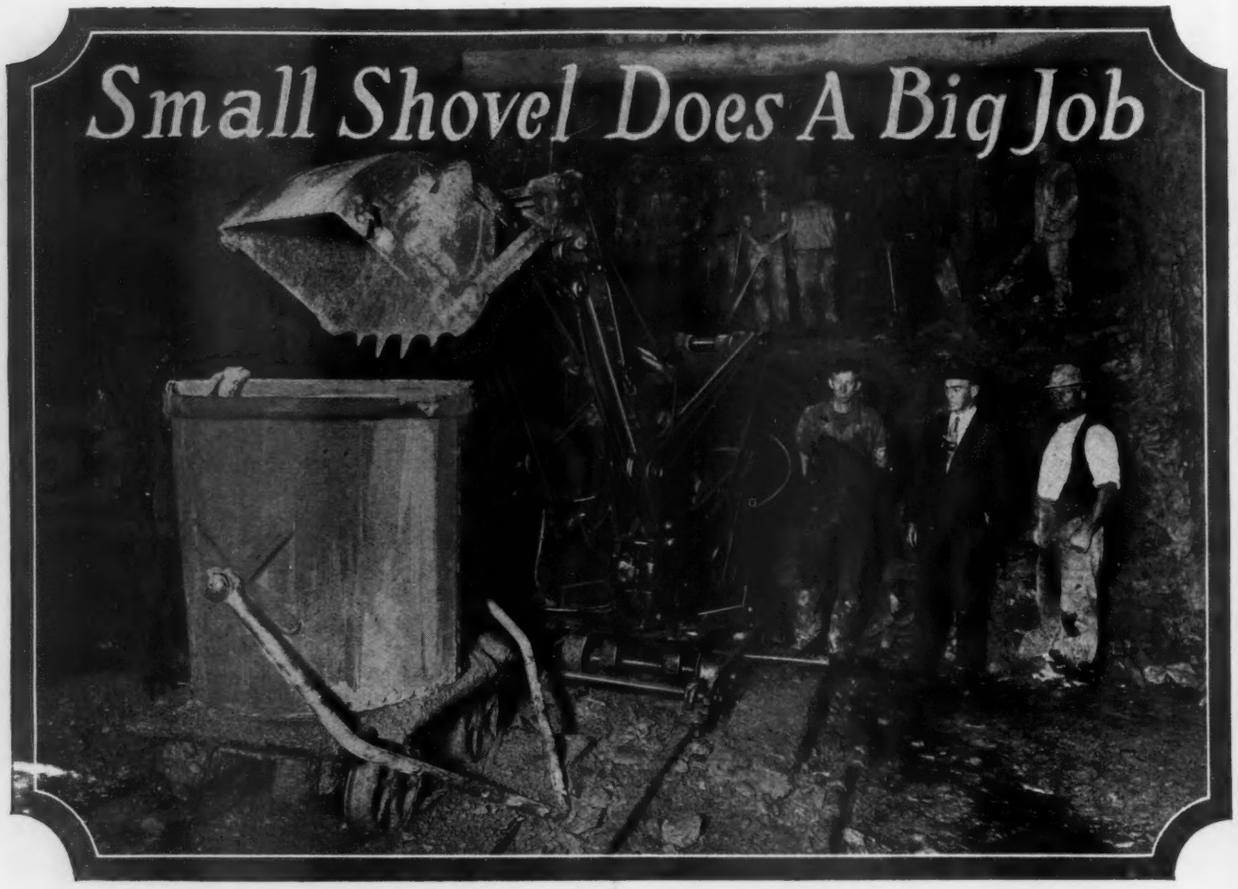
137-SOE

Ingersoll-Rand



Nordberg-Butler Shovel serves equally well in large or small tunnels and drifts

Although of compact design to permit working in narrow tunnels and drifts, the performance of the Nordberg-Butler Shovel on big jobs is surprising. Too often it is considered by some as a machine suitable for confined places only. The above illustration shows it working in a 16 x 20 foot subway being built in Sydney, Australia. Here as in other instances, it is giving the same service as is expected in larger and more costly underground loading machines.

In addition to low price, the Nordberg-Butler Shovel also has the advantages of greater flexibility and usefullness under varied operating conditions. While it may be placed in the small shovel class, it is so designed and constructed of properly chosen materials and correctly proportioned parts that light weight has been secured at no sacrifice of strength and durability. Compactness of design without excessive weight has resulted in a shovel that is extremely mobile, it being possible to transport it to various working faces without difficulty.

If conditions are such that machine loading is at all possible, the Nordberg-Butler Shovel will reduce loading costs and permit of faster operation. Bulletin DR-6 describes this unusual machine.

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The tube of this efficient hose is specially compounded to resist oils. The body is made of stout plies of rubber—impregnated canvas, resilient to the pulsating pressures, and quick to return to full round when pinched or flattened. A good, thick, tough cover protects against abrasion in hard usage.

Goodyear Air Hose resists the effect of kinking to the maximum degree.

For detailed information about this and other types of Goodyear Hose, write to Goodyear, Akron, Ohio, or Los Angeles, California.

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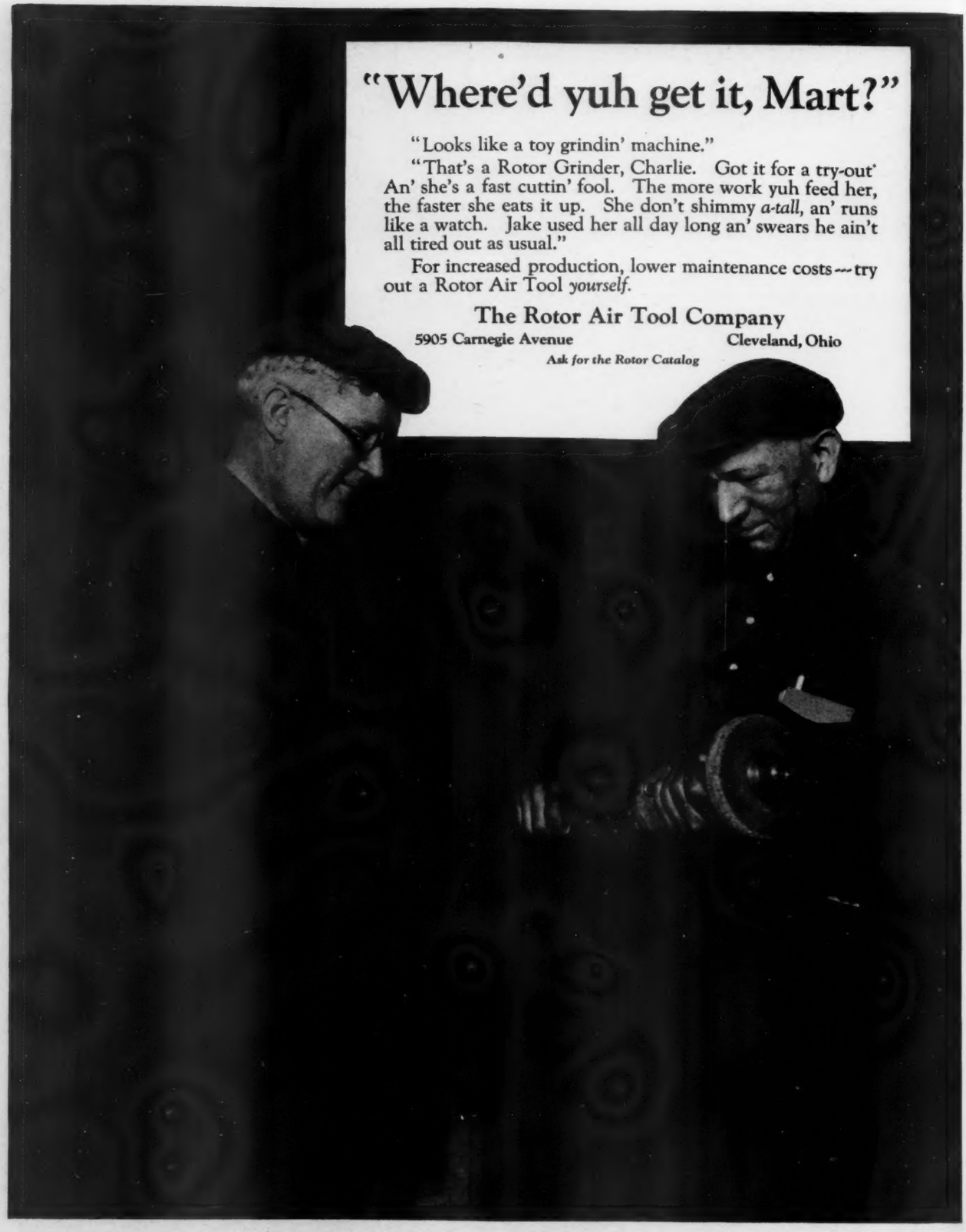

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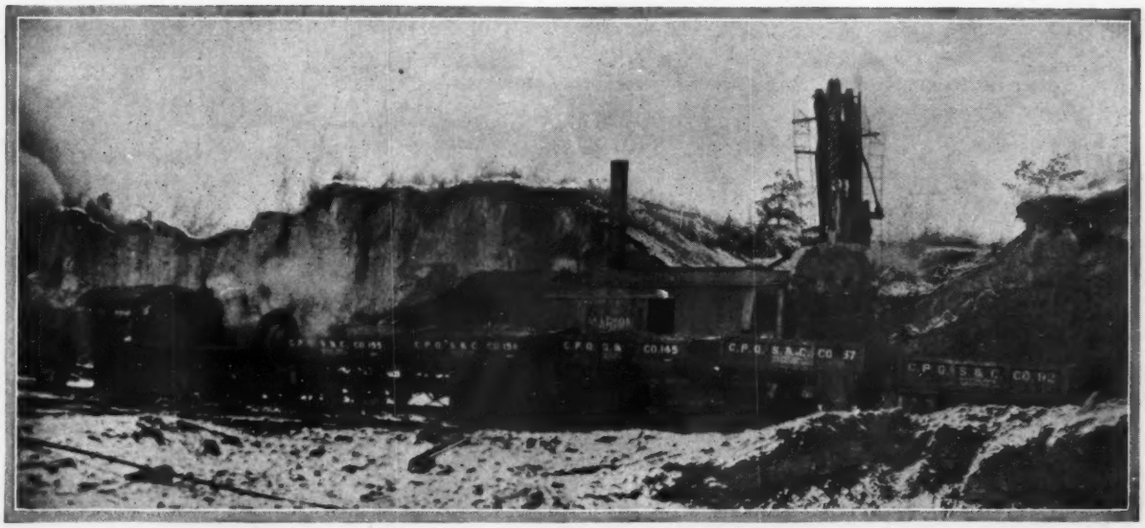
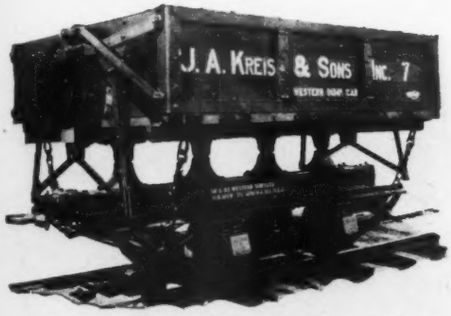
Rotor Air Tools



One of the Central Pennsylvania Quarry, Stripping & Construction Company's trains of Western 4-yard dump cars under the shovel. This company has installed nearly 300 4-yard Westerns.

Endurance is the Big Thing



Western 5-yard Heavy Duty Dump Car.

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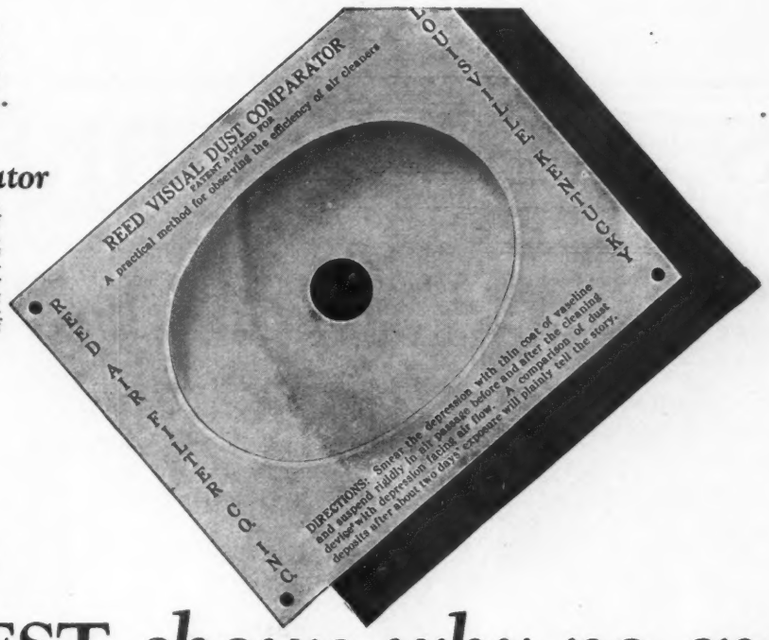
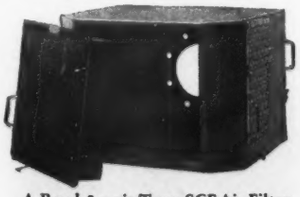
Get this FREE *Reed Dust Comparator*

Suspend it in the air intake. See for yourself the heavy deposits of harmful dust collected in only a few days. *Know why Reed Filters increase the life and efficiency of equipment from 25% to 75% and pay for themselves by savings in lubricating oil alone!* Comparator and complete data sent free on receipt of coupon below.



This TEST *shows why no engine or compressor can remain efficient without* FILTERED AIR

A pound of dust removed *in one week* by a Reed Air Filter in a "clean" city where dust content was only two grains per 1000 cubic feet of air!



A Reed 3-unit Type SCF Air Filter —capacity 1800 CFM. Other types of Reed Filter for every size and make of engine and compressor and for general and industrial air-cleaning.

Don't be misguided by the fact that your engine or compressor is still meeting your full requirements. Remember that you have reserve power in your engine and reserve capacity in your compressor. Regardless of how well your equipment may seem to be operating, *it may already have lost most of its reserve—from 25% to 50% of its original efficiency—without this loss becoming apparent.*

Know the facts. *Know* the quantity and character of the abrasive dust in your air and you will follow the advice of leading engine and compressor manufacturers by installing Reed Air Filters. Send for a Reed Visual Dust Comparator, make the test described above and *get the evidence for yourself.* Use the coupon for convenience. REED AIR FILTER CO., *Incorporated*, 214 Central Avenue, Louisville, Kentucky.

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filters ALL METAL

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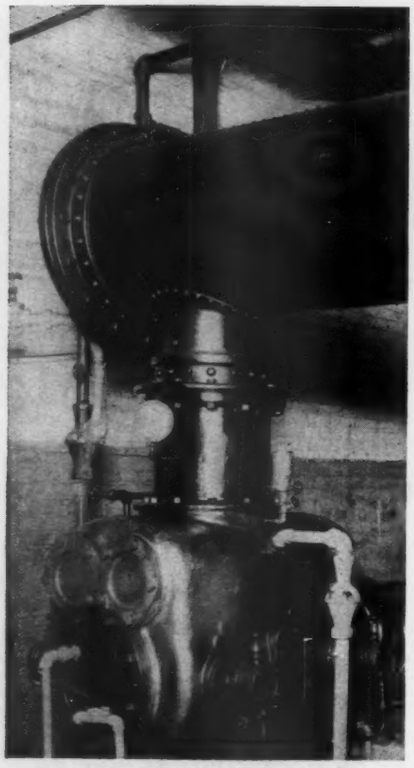

These five words are the best lubrication instructions to give the operator of every air compressor.

But remember, a "minimum feed" lubricant must be a high-grade lubricant.

Use only a rich lubricating oil such as Gargoyle D.T.E. Oil Heavy Medium. Here are 7 good reasons for its use:

1. It is the most widely used air-compressor lubricant.
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5. It reduces the formation of deposits from surplus collections of oil around the valves.
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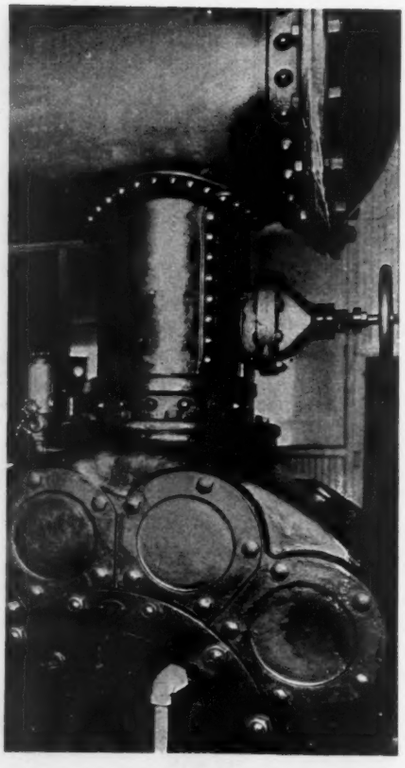
NOTE: On request we will send you, without obligation, our authoritative treatise: "Air Compressor Lubrication." Write for your copy.



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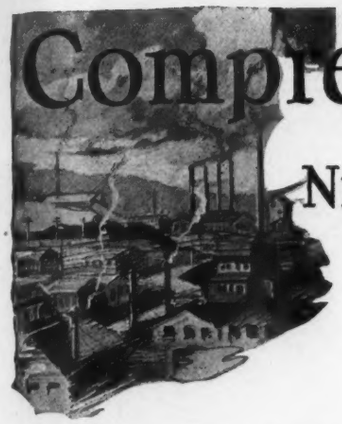

Compressed Air Magazine

NEW YORK · LONDON · PARIS

Principal Offices
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VOL. XXXIII, NO. VIII

AUGUST, 1928

Big Four-Tracking Job on New York Central Railroad

Oil-Engine Compressors Furnish Operating Air to Rock Drills Driving Tunnels and Widening Right of Way

By S. G. ROBERTS

IN order to provide for four tracks over a 15-mile section on its Hudson River division, the New York Central Railroad Company is driving one tunnel nearly 500 feet long; enlarging and lining two other tunnels; and widening the right of way—the whole job entailing the excavating of substantially 800,000 cubic yards of rock.

In certain instances the removal of this rock has called for much line drilling, and in others for the utilization of special drill carriages so as to permit the excavating to be done with the least practicable jarring of the remaining rock.

The prosecution of the work demands the use of a large volume of compressed air; and the nature of the undertaking has necessitated the shifting, from time to time, of the compressor plants. To insure operating economies, the contractor has equipped himself with eight 110-hp., oil-engine compressors having a combined output of 4,000 cubic feet of air a minute.

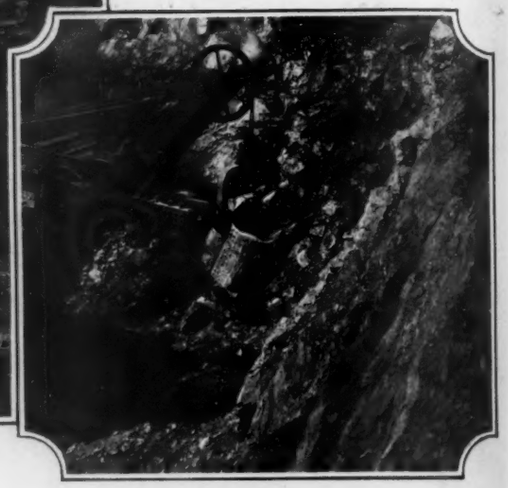
THROUGHOUT a stretch of fifteen miles on its Hudson River division, the New York Central Railroad Company has been engaged for a little more than a year in grading, widening the right of way, and tunneling so as to provide four tracks for its continually increasing traffic to and from the Metropolis. This is additional evidence of the New York Central's ceaseless efforts to keep its system more than abreast of current demands so that the traveling public and shippers may have everything that they can reasonably expect of an up-to-date railway.

The section in question lies along the picturesque Hudson River extending from near Manitou, N. Y., northward to a point beyond the tunnel that now pierces the western slope of Breakneck Mountain. By 4-tracking this part of the road greater freedom of movement is assured, and a larger volume of traffic can be handled expeditiously. Just how busy the line is can be grasped when it is realized that there is a daily passage of 125 trains over that stretch of the road. As a matter of fact, this intense activity has imposed certain restrictions upon the contractor, the Walsh Construction Company of Davenport, Iowa, and, to that extent, has made the prosecution of the work more difficult. The contractor has to carry on his several associated jobs in a manner that will not interfere with the scheduled running of the numerous trains mentioned.

The Walsh Construction Company has had a great deal of experience in railroad work, and is justly reputed to be one of the best-equipped large contracting concerns in the United States—always seeing to it that its plant shall be ample and of a thoroughly modern make-up. By reason of this, and its able management, the company is noted for its celerity of performance. The present undertaking includes a number of operations of a novel and, withal, difficult nature. Special facilities have been devised and unusual methods resorted to in order to deal successfully with different situations. Before touching upon the details of the work, let us outline the main features of this rather complex and varied job.

The undertaking may be divided broadly into four main operations: First, the enlarging of an existing tunnel at Garrison, N. Y., so as to increase its width to 38 feet and its height to 26 feet—incidentally lining it with concrete, and, at the same time, straightening out and broadening the right of way north of the tunnel by removing a point of rock 85 feet high; second, the driving of a 2-track tunnel parallel to and west of the present Breakneck Tunnel, and the enlarging of the present Breakneck Tunnel so that all three of the tunnels shall have a maximum width of 38 feet and a height of 26 feet; third, the widening of the cut north and south of Cold Spring for some distance so as to permit the laying of two more tracks; and, fourth, the widening of the right of way between Garrison and Manitou for four tracks—this work entailing the clearing away of a ledge that rises to an average height of 60 feet and parallels the road for 5,000 feet. All told, the different operations require the excavating of substantially 800,000 cubic yards of rock. The Garrison Tunnel and its approaches have necessitated the removal of 40,000 cubic yards of rock; and the tunnels and approaches at Breakneck will call for the excavating of 40,000 cubic yards of rock.

The contractor has not been allowed to do any heavy blasting close to the main or side tracks nor near any other structures of the railroad. Because of this restriction, he has had to proceed with the utmost care in enlarging the tunnel at Garrison. That tunnel is flanked by a 2-track open cut—the inter-



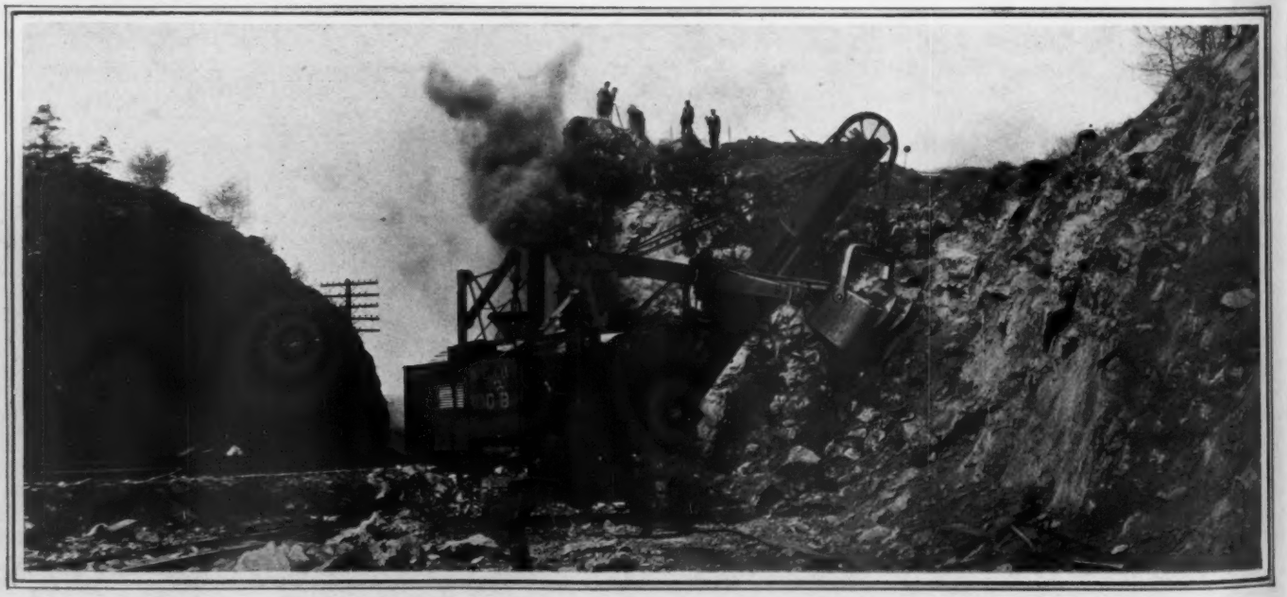
Left—Drilling deep holes with X-71's, on tripods, in excavating 350,000 cubic yards of rock in the cut north of Manitou, N. Y. Right—The capacious dipper of the largest power shovel on the job.

vening wall of rock being about 40 feet thick. In its original form, the tunnel contained two tracks; but the New York Central Railroad Company desired to line that tunnel with concrete and to so increase its height and width that it could accommodate the newest and the largest types of rolling stock.

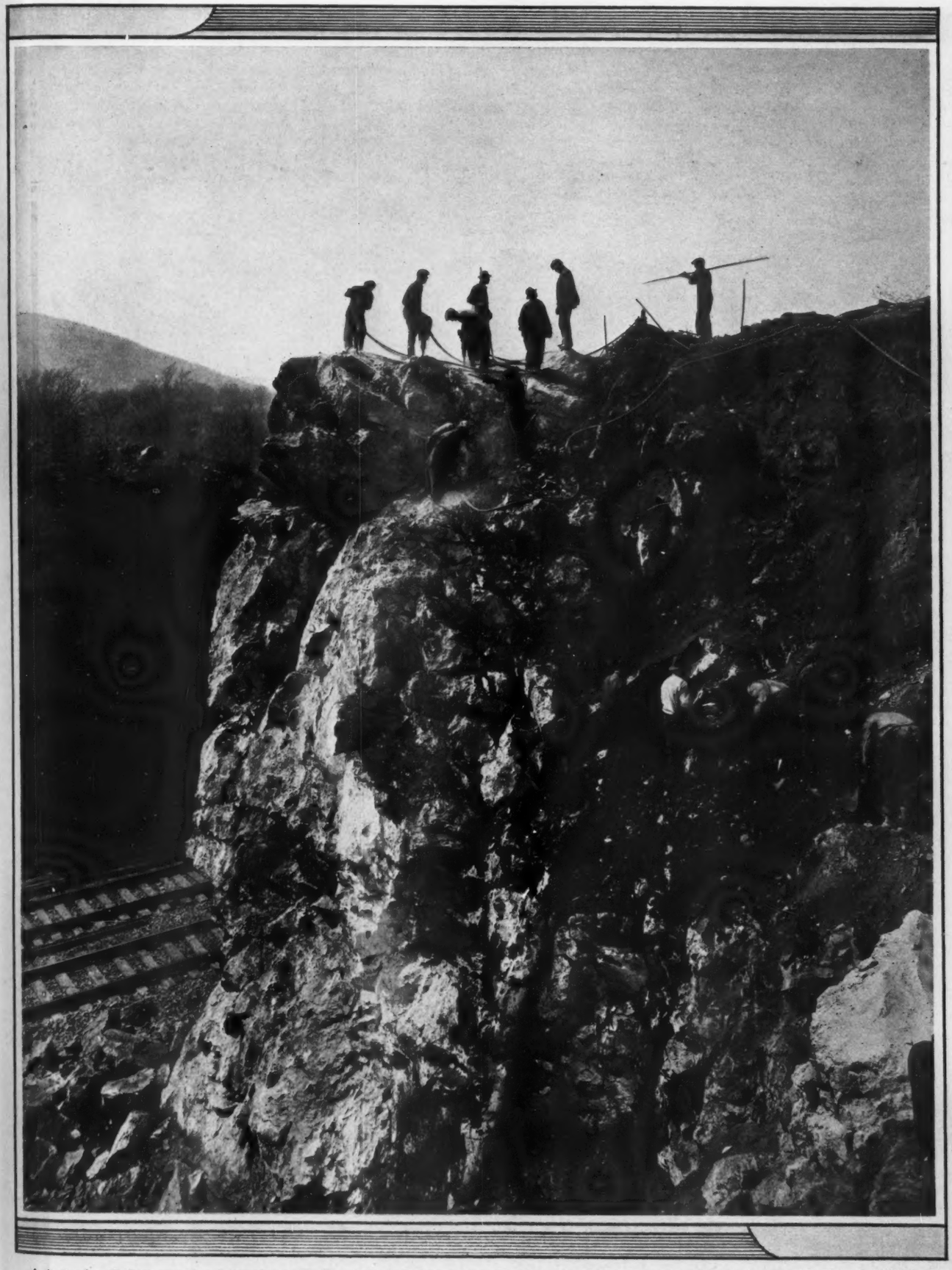
To accomplish this, it was necessary to remove a tapering section—starting at the springline on the west side of the tunnel—by first taking out about a foot of rock and then widening out to the crown and downward, on the east side, to the base of the wall, where the width of the tunnel was increased by 14 feet. The task was an exacting one, because the drilling and blasting had to be done so as to disturb the remaining rock as little as possible and not to cause a break or slide into the adjacent much-used open cut. The ring drilling was done with holes spaced 3 feet apart; and ¾ pound of explosive was employed per cubic yard of rock excavated.

For this work a special drill carriage was devised and mounted upon a flat car; and the carriage was equipped with one R-51 stoper and three X-71 drifters. The stoper drilled the holes in the arch for 45 degrees on each side of the vertical; and the drifters did the rest of the drilling. One of our pictures gives a good idea of this extemporized drill carriage and of the arrangement of the stoper and the drifters.

The Garrison Tunnel is 470 feet long, fro portal to portal; and 10,000 cubic yards o rock was removed in the actual enlargeme of the old tunnel. A daily linear advance o 12 feet was made in excavating the tunnel i full size. In placing the concrete lining, linear feet of arch and side walls were poure daily—the arch and the side walls being ca separately, and wooden forms were used. pneumatic concrete-placing machine did th work, operating at a pressure of 100 pound per square inch. The machine handled cubic feet of concrete in a batch; and the were 240 cubic yards in each 24 linear feet combined side walls and arch. Air for th machine was furnished by two Inger-so



This big Bucyrus shovel is able to handle 4 cubic yards of rock at a time.



A towering ledge, south of Garrison, N. Y., that is being cut away for a horizontal depth of 50 feet and a length of 5,000 feet to provide additional space for four tracks.

Rand 10x8-inch portable compressors.

In widening the open cut to the north of the Garrison Tunnel approximately 150,000 cubic yards of rock was removed. The deep holes were drilled with X-71 drifters, mounted on tripods; and holes 20 feet in depth or shallower were put down with N-72 sinkers. Compressed air for driving the rock drills at Garrison was provided by four POC-2 oil-engine compressor units, each of 110 hp.

The present Breakneck Tunnel will be enlarged in the same way as was the Garrison Tunnel—the existing west side wall being cleared away and the arch broadened and heightened. This will not be done, however, until the new tunnel, now in hand, is ready for service. The present tunnel is 540 feet long, while the new tunnel—now being advanced from both ends—will be 450 feet between portal faces. The method employed in driving the new tunnel is both novel and interesting. This tunnel lies between the much-used existing tunnel, on the east, and the shaft house, on the west, of the Hudson River siphon of New York City's vital Catskill water-supply system. Therefore, the work must be executed in a manner that will insure the security of these flanking and important structures.

To this end, the engineers of the New York Central specified that the contour of the tunnel section should be drilled and broached so as to provide an outlining curf or channel—this channel always to be finished before the 8x8-foot center heading is driven in the rock core. The rock between the center heading and the curf, which is to be removed last, is ring drilled from the center heading. Holes for this purpose are drilled close enough for small charges of powder to bring down the rock.

To meet the specifications, the contractor devised and outfitted two exceptionally large and ingeniously equipped drill carriages, supported by a single flat car in each case. The carriage is arranged to mount 14 drills; and two columns support the drills used in driving the center heading and in doing the radial drilling. The drills that do the curfing are mounted on a frame made up of 4½-inch pipe bent so as to conform to the tunnel section and suitably braced longitudinally by sloping stanchions—also of 4½-inch pipe—which are secured at the rear to the floor of the car. Screw jacks can be fitted to the arch of this frame at three points to anchor the carriage; but both of them have proved so steady that the jacks have not been needed.

Channeling is done with twelve X-71 drifters, and center heading and ring drilling with N-72 drifters, N-72 sinkers, and R-51 stopers. In drilling and broaching the curf, the holes are 2⅜ inches in diameter and deep enough to pull 6 feet at a round, every 24 hours. The broaching tool is 1⅛ inches in thickness and 3 inches wide. All drilling is wet—the water tubes being withdrawn only for broaching. Each round entails the drilling of 330 holes; and these represent a total linear footage of 4,000 feet, of which 1,700 feet are required for core cutting. Delay charges from 1 to 6 are used. The bottom of the tunnel section is removed by means of lifters

Top, left—North portal of Garrison Tunnel before it was lined, with 2-track open cut at left. Right—North portal of Garrison Tunnel after the concrete lining was in place. Bottom, left—Drill carriage used in enlarging the Garrison Tunnel. Right—Barring down loose rock after a blast in the Garrison Tunnel.

1—Drillers at work on upper platform of drill carriage channeling the arch curf. 2—Close-up of curf of crown that is being drilled and broached with X-71 drifters. 3—South portals of new and old Breakneck tunnels on the New York Central Railroad. 4—Blacksmith shop at south end of Breakneck Tunnel, equipped with a No. 25 oil furnace, a No. 8 pedestal grinder, and a No. 5 "Leyner" sharpener. 5—Three POC-2 oil-engine compressors furnish air for all operations at the north and south portals of the new Breakneck Tunnel.

Left—Blacksmith shop, near Manitou, equipped with an I-R oil furnace and a No. 50 "Leyner" sharpener for conditioning the numerous drill steels in service. Right—An X-71 beginning the work of removing a high point of rock in widening the right of way for four tracks.

spaced 24 inches apart and 6 feet deep.

Besides making it possible to do the excavating with the least practicable concussion to the surrounding or neighboring rock, the drill carriage has this added advantage—it can be back and at work within ten minutes after the mucking is finished. In other words, the apparatus avoids the loss of time that would be incurred if all the drills had to be set anew. The mounting of the drills is such that they can be quickly and easily shifted upon the supporting pipe frame in doing the channeling. The rock penetrated is a diorite with pegmatite dikes; and its hardness ranges between 6 and 7.

Compressed air is delivered to a single receiver on each drill carriage; and, in turn, the air goes to a manifold equipped with as many connections as there are drills to be run. One of our illustrations shows this receiver and the associate manifold, as well as the hose connections that link the manifold with the various sinkers, drifters, and stopers. Air is fed to the receiver through a 4-inch flexible line. The carriages have been found to answer perfectly for the work for which they were designed and built; and they have blazed the way for a new method of driving large tunnels. Undoubtedly, these carriages will arouse much interest when knowledge of them becomes widespread.

Air for the I-R oil furnaces, the "Leyner" sharpeners, and the pneumatic pedestal grinders in the blacksmith shops at both ends of the Breakneck Tunnel, and for driving the rock drills on that section of the contract, is furnished by three Ingersoll-Rand POC-2 oil-engine compressors. The compressor house is adjacent to the south portal; and air for use at the north portal is piped from this plant through the present service tunnel.

Substantially 30,000 cubic yards of rock was excavated at Cold Spring, north and south of the station; and when that work was in hand the drills were supplied with air from a single 110-hp. POC-2 oil-engine compressor set up near the station. This machine also provided air for the drills used in clearing away 15,000 cubic yards of rock in a cut between Cold Spring and the southern end of the Breakneck Tunnel. At the present time, the biggest open cut in rock is that being made just north of Manitou and south of Garrison. As previously mentioned, the cut is 5,000 feet long, and in many places it is 60 feet high. The average width is 50 feet; and the amount of rock to be removed is about 500,000 cubic yards.

The deep holes on this part of the job are drilled with X-71's, mounted on tripods, and the shallow holes with N-72 sinkers. Air for this work comes from two compressor plants. At one plant there are three POC-2 oil-engine compressors and at the other there are two of these 110-hp. units. The blacksmith shop associated with this section of the contract has an I-R oil furnace, a No. 8 pedestal grinder, and a No. 50 "Leyner" sharpener, so that the numerous drill steels in use can be kept fit for the service required of them.

When the Walsh Construction Company contracted to drive a new tunnel at Break-

Top—Express train speeding through open cut at Garrison, N. Y. Left—Air receiver and manifold on one of the drill carriages at the Breakneck Tunnel. Right—South portals of old and new Breakneck tunnels.

1—North portals of old and new Breakneck tunnels. Note nearness of new tunnel to shaft house of Hudson River siphon of Catskill water-supply system. 2—Close-up of drills mounted on crown of drill-carriage frame. 3—Rear view of drill carriage outside north portal of Breakneck Tunnel. Air receiver and associate hose manifold visible beneath ladder. 4—Line drilling was extensively employed in clearing away rock at approach of north portal of Breakneck Tunnel because of nearness of shaft house of Catskill water-supply system. 5—Here we see how the curf was drilled and broached, in successive rounds, in early stages of work at north portal of Breakneck Tunnel.

Top—Section gang getting ready for the run home after a day's work. Left—Where the road is being 4-tracked just north of Manitou. Right—Compressor house and blacksmith shop near Manitou.

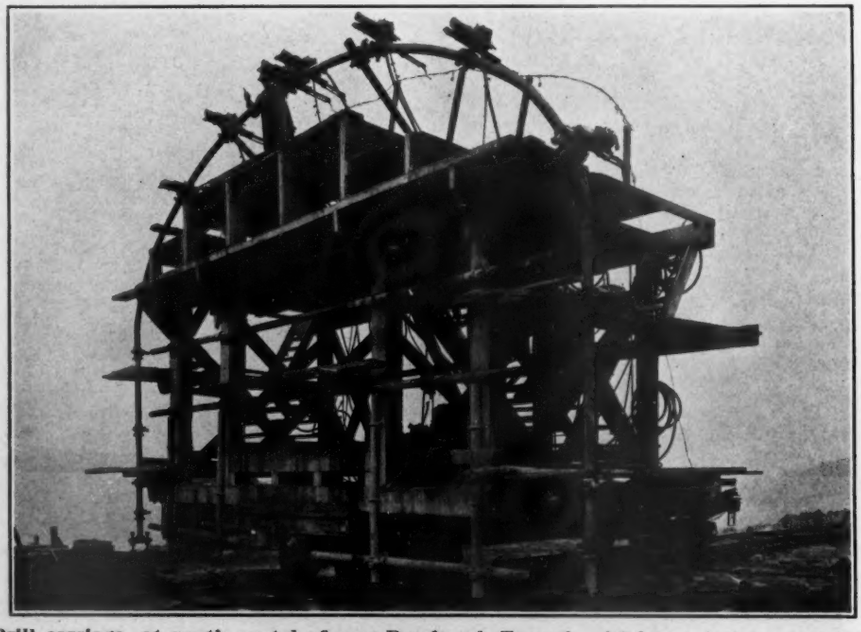
neck; to enlarge the existing tunnels at Garrison and at Breakneck; and to do the other extensive rock excavating and grading involved in providing fifteen miles of 4-track line, it was apparent that much power would be needed for different purposes, and it was equally self-evident that as the scene of operations shifted it would be necessary to make the power available at the new focal centers of activity. After due deliberation, it was decided by the Walsh Construction Company that its main sources of power should be stationary plants composed of one or more oil-engine compressor units, and that portable compressors should be drawn upon at other points for smaller volumes of operating air.

Today, the company has in operation, within the section of the Hudson River division already mentioned, a total of eight of these Ingersoll-Rand oil-engine compressors; and several of them have been moved up and down the line to different positions as some parts of the work have been finished and other parts have been taken in hand. The hourly output of each of these units is equivalent to 30,000 cubic feet of free air raised to a pressure of 100 pounds per square inch. Inasmuch as the units are guaranteed to operate individually on six gallons of fuel oil an hour, then, at 6 cents a gallon, each of them can deliver 1,000 cubic feet of air at 100 pounds pressure for $0.012.

With good reason, the contractor is satisfied that he has saved money by thus equipping his own power plants and by having them sufficiently mobile so that he can shift them as circumstances may demand. What the Walsh Construction Company has done in this respect will probably be found of suggestive value to other concerns engaged in similar work or in handling contracts that may be likened to it in a number of ways.

The Walsh Construction Company has offices in Davenport, Iowa; Syracuse, N. Y.; Indianapolis, Ind.; Cleveland, Ohio; and Chicago, Ill. Its officers are: T. J. Walsh, president; H. C. Kahl, vice president; David Small, vice president; E. P. Walsh, treasurer; and M. A. Kennedy, secretary. Mr. Kahl is the dominating spirit directing the New York Central work we have been describing. No wonder, the scenes of operation are busy ones and fine examples of orderly effort even when speeding along "on high".

From 50,000,000 to 60,000,000 tons of ice are manufactured annually in the United States.



Drill carriage, at north portal of new Breakneck Tunnel, withdrawn before mucking. Note manner in which drills are mounted to do the curfing.

ONTARIO INVESTIGATES MINE SAFETY

A Royal commission, appointed to investigate the cause of a recent mine-fire disaster in Ontario and to discuss ways and means of improving safety conditions in the mines of that province, urges, among other things—reports the United States Trade Commissioner at Toronto— that sprinkler systems be installed at all underground crushers and in dry shafts; that telephone systems be installed underground with connections through different workings; and that fire doors be placed in shafts and underground transformers.

The necessity for underground sprinkler systems is questioned by some mine managers, it being pointed out that most shafts are continually dripping with water; but it is noted that a disastrous fire occurred in a mine recently in spite of this condition. The telephone as a safety device has the drawback that the bell can be heard only a short distance in the shafts, particularly while rock drills are working. One mine has a siren system so arranged that, when any one alarm box is broken, sirens sound throughout the whole mine. However, even these, at best, can be heard only a few hundred feet away.

Another warning system which has been suggested is that of pumping stench chemicals through the air lines. Although dependence has been placed on natural ventilation, it is now needful, because of the depth to which some workings have been carried, to consider the possibility of installing mechanical ventilation.

Denver Gets Natural Gas From Texas

DENVER housewives are now frying the morning "ham and" over a fire of natural gas piped for a distance of 340 miles from the Amarillo field in Texas. Whether or not they give a thought the while to the work that has made this possible, it remains to be said that it marks an outstanding achievement in the history of the gas industry of the United States. The cost of the project, including gas properties, pipe lines, compressors, absorption plants, etc., is estimated at $25,000,000; and 346 square miles of territory are held in reserve so as to assure an ample supply of gas for years to come not only to Denver, but also to Trinidad, Pueblo, Colorado Springs, and numerous other smaller communities. The gas rights in the Amarillo field comprise more than 350,000 acres, upon which there are now 25 wells with an aggregate daily capacity of 625,000,000 cubic feet of gas.

According to contract requirements, the pipe line was to be completed and ready for service by October 1 of this year, but so well has the work progressed that gas was turned into the main almost four months ahead of schedule. This is a splendid record, when it is considered that operations were begun on December 13, 1927, and that in the neighborhood of 2,000 carloads of pipe, couplings, bolts, etc., were used to build the main.

Throughout the greater part of its run, starting at Amarillo, the line traverses open plains; but in New Mexico and in southern Colorado rugged ground was encountered, necessitating the negotiating of rocky canyons, rivers, and small streams. In many instances, where the route for miles on end passes through undeveloped country, roads had to be constructed to facilitate transportation. At one point east of Colorado Springs, for example, a right of way had to be cut through twelve miles of timberland.

Ditching machines were used to do the trenching in the open country—the gangs averaging a mile per working day. By keeping them going continually, day in and day out, the ditchers were kept about 5,000 feet ahead of the layers, who not infrequently placed from 12,000 to 13,000 feet of pipe in 8½ hours.

For the most part, the main consists of 20-foot sections of 22-inch and 20-inch plain-end pipe, connected with Dresser couplings. For the crossing of the rivers, lengths of screwed pipe, 10 inches in diameter, were used. These were sealed at the joints with collar-type clamps, weighing 1,550 pounds each, machined on the inside to an exact fit. To effect the crossing, the pipe units were first assembled; next the line was dragged across the river bed and laid in position; and then the trenching was done. All told, six mains of this description were run across the Arkansas River and seven across the Huerfano—the conduits being linked to the trunk line by suitable headers or manifolds. This part of the job was accomplished without difficulty because the water in the respective rivers was at a low stage.

At certain points along the route, where small streams were encountered, it was needful to build watertight cofferdams by driving two paralleling rows of planking into the loose, sandy bottom. Pneumatic pile drivers were employed to do this work and also to keep the sheeting in place in the porous soil while the areas were being unwatered and the trenches dug. Compressed air for the operation of the pile drivers was supplied by a portable compressor. In this way, two men were able to keep the cofferdam intact in the unstable ground and to prevent sand and water from swamping the muckers.

While gangs were busy constructing the 340-mile main between Amarillo and Denver, others were engaged in laying around the latter city a ring of piping from which numer-

Top, left—Where the gas main was run through Cherry Creek, Denver, showing the cofferdam built to hold the sand and the water at bay. Right—Portable compressor which supplied air for the pneumatic hammers used to drive the sheeting into the creek bed. Bottom, left—Two men with air hammers were continually on the job keeping the wooden planking in place in the unstable bottom. Right—Joining pipe lengths preparatory to laying in the trench.

ous laterals now reach out into well-nigh every quarter of Denver supplying gas for domestic and industrial use.

Before work on this momentous project was started, samples were taken, at 1,000-foot intervals, of the soil all along the right of way. These were analyzed; and the knowledge thus acquired was applied with profit in painting the piping in order to protect it against erosion. In other words, the thickness of the coat was determined by the character and the moisture content of the soil. Something of the same sort, but not on so large a scale, was done in the case of a similar job in Louisiana.

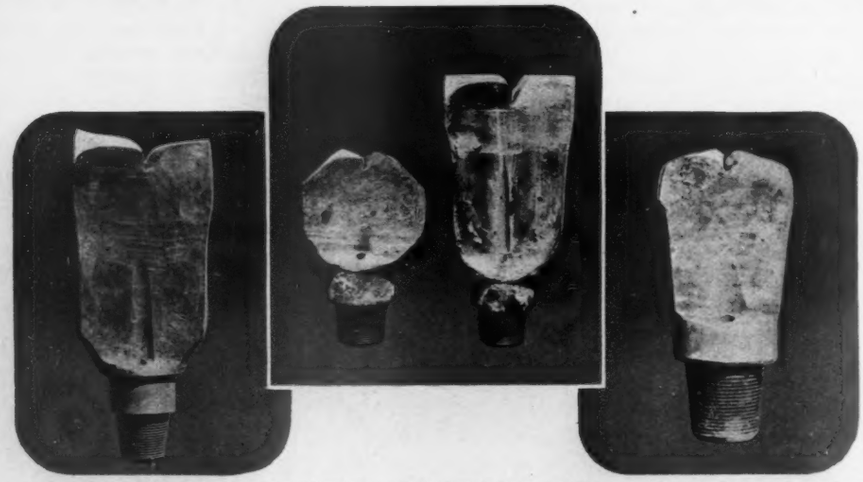
STELLITE FOR OIL-WELL DRILL TOOLS

FOR some years now it has been recognized, in the metal-working industries particularly, that the use of stellite in connection with high-speed cutting tools, cutting and forming dies, and the like, means tools and parts of exceptional durability. Stellite insures longer life to the cutting edge, in fact, to any wearing surface, and for that reason is being more and more extensively applied in other departments of industry to metal parts that are subjected to wear. These include bushings, cams, rollers, punches, bending tools, valves, valve seats, etc. Latterly, stellite has also been doing excellent service in the oil field; and it is with this newer use of the metal that we shall deal here. But before doing this it might be well to give a brief outline of the history of stellite, which is an alloy of chromium, cobalt, and tungsten.

Stellite was first discovered about fifteen years ago by Elwood Haynes, whose idea then was to provide a nontarnishable metal for the manufacture of cutlery. Its employment in this direction, however, soon lost its outstanding importance when the characteristics of the alloy and its possibilities for high-speed cutting tools became known. High production costs at first proved a serious setback to its adoption by the metal-working industries; but this handicap was overcome subsequently by applying stellite in small quantities at any desired point on a tool or part where it could be counted upon to do the most good.

The process developed for this purpose is termed "stelliting"; and stellite can be applied either with the oxy-acetylene blowpipe or the electric arc. Stelliting, however, calls for a somewhat different method from that in common use. In practice, from 2 to 3 inches of the stellite rod is held in the flame. This keeps the rod sufficiently hot so that when the base metal just begins to sweat the alloy can be "flowed on" quickly—speed at this stage in the operation being essential. To prevent the formation of blowholes, all scale, dirt, and other foreign matter must be removed from the metal before the stellite is applied.

Stellite is a cast metal of exceptional hardness that retains its hardness even at a temperature of 1,830° F.—in fact, long after a steel tool would be apt to soften. This inherent hardness, together with its resistance to abrasion; its melting point at about 2,300°F., which is nearly that of steel; its co-efficient of expansion which is virtually identical with that of steel; and its tendency to oxidize but slightly at melting temperature, combine to make stellite especially suitable for some services in oil fields—for example, for drill bits.



Left—Stellited fishtail bit with deposit too thick at edges. Center—Effect of wear on steel bit, at left, as compared with a properly stellited bit. Right—The stellite deposit on the cutting edges of this bit is too heavy at the center.

"An interesting feature of the stellited bit", so it is said, "is that the steel, being softer than stellite, wears away, providing an automatically formed relief and protruding cutting edge of the harder surface metal that will continue to 'bite' long after an all-steel tool would have become blunt and useless. Without this relief the edge cannot bite into the formation unless greater pressure is exerted, and it is this additional pressure that causes the hole to become crooked. Therefore, a stellited bit may safely be fed faster than one of plain steel."

Stellite can be applied with profit to a wide variety of oil-well drilling tools; but, probably, its commonest use in this service is for surfacing fishtail bits. The upper contour of the stellite deposit on the fluke of a fishtail bit should approximate the shape of the bottom of a worn bit. For reasons of economy the bit should wear off to a straight line across its end. To obtain this result the thickness of the metal coating should vary according to the amount of abrasion it receives; and just as steel should be thicker at the corners than at the center so should there be a heavier deposit of stellite towards the corners. If the stellite is too thick at the center the edges will wear too rapidly. Conversely, if the edges are too thick the center will wear too fast. The accompanying photograph of three bits illustrates the points just raised.

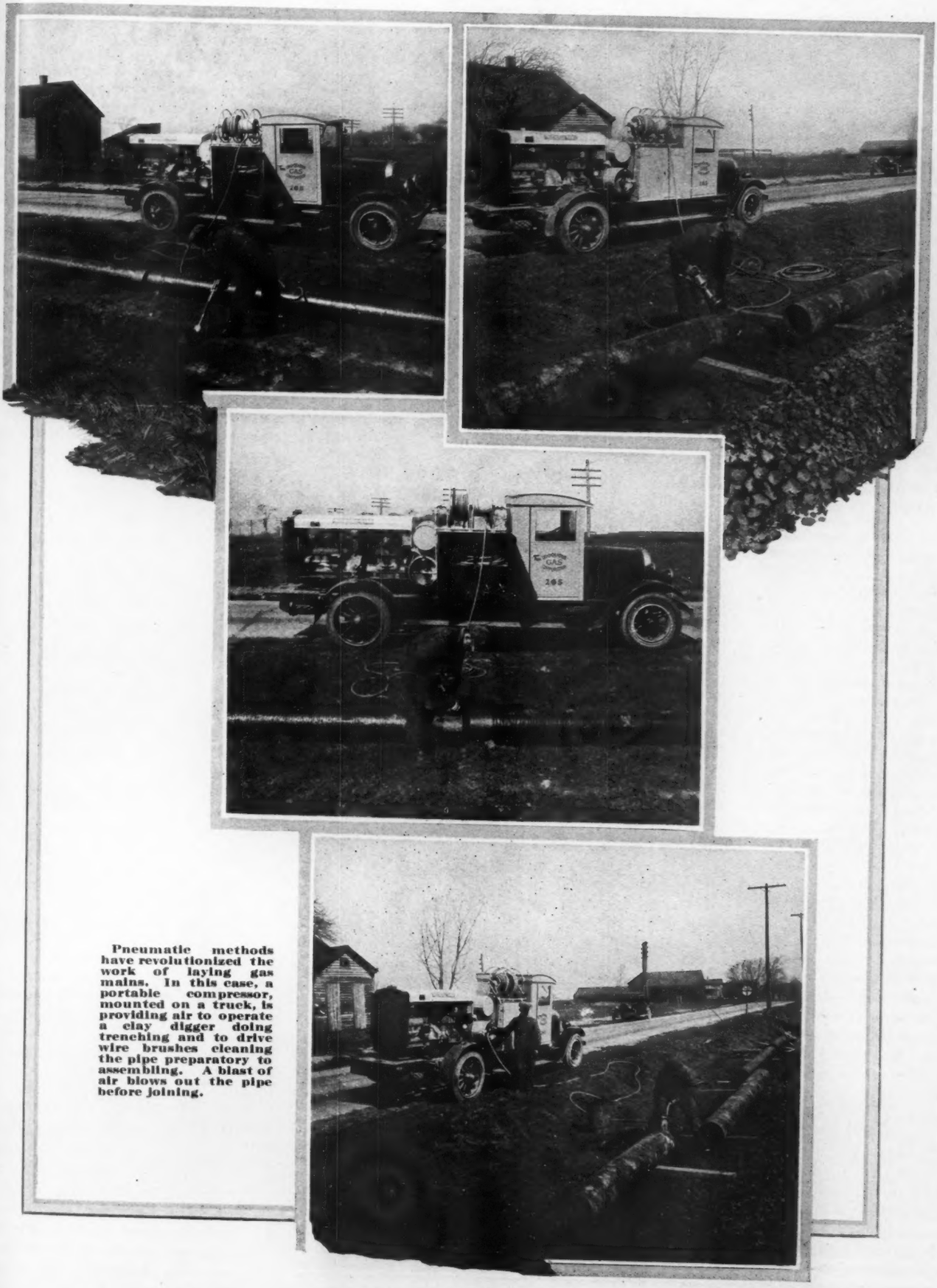
Savings are effected in several ways by the use of stellited well-drilling tools; and not the least of these is in lessening the number of tool replacements. It has been reported by the American Petroleum Institute that about 25 per cent of the drilling time is lost in making round trips to replace dull bits. Added to this is the depreciation of certain equipment due to frequent changing of bits. But, perhaps, the best index to service rendered is the gain made in footage with stellited tools as compared with all-steel tools. The accompanying table is a record of progress made at two 3,600-foot wells in identical formations.

The total saving in drilling cost in favor of the well drilled with stellited tools amounted to $3,018.50; and it should be remarked that this figure makes no allowance for the savings effected in maintenance costs by completing the well in less than two-thirds the time that would have been required by the use of all-steel tools and by lessening the likelihood of fishing jobs. One large operator, who conducted a series of tests which resulted in the adoption of stellited cutting edges for his drills, reported an increase in footage five times that previously obtained by him with other metals.

In confirmation of this, let us quote what the Department of Petroleum and Gas of the California State Mining Bureau had to say on this subject in a report published in 1925: "Stellite-finished bits have been tried in competition with steel bits of highest quality. A bit with stellite properly applied will make about three times as much hole per run as an all-steel bit. The resulting economy is greatest in deep holes, due to the reduction in time incident to changing bits. An additional saving is due to the fact that the stellite bit may be fed at a greater rate of speed than the all-steel bit, and the hole is made quicker with it."

	Steel	Stellite	Increased Service
Footage	41.50 ft.	98.00 ft.	136 per cent
Drilling rate, per hour	5.72 "	8.89 "	56 " "
Total working time	629 hrs.	402 hrs.	36 " "

At the beginning of 1928 there was in use throughout the world a total of 29,687,499 automobiles, or 7.6 per cent more than at the same period in 1927.



Pneumatic methods have revolutionized the work of laying gas mains. In this case, a portable compressor, mounted on a truck, is providing air to operate a clay digger doing trenching and to drive wire brushes cleaning the pipe preparatory to assembling. A blast of air blows out the pipe before joining.

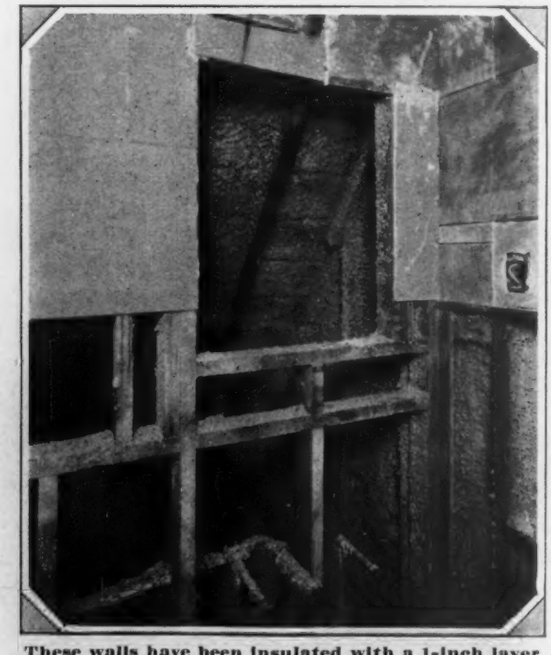
The air spray in action, showing the mechanism that feeds the confetti-like mass to the gun.

NEW INSULATING MATERIAL APPLIED BY SPRAY GUN

SOMETHING novel in insulating materials for buildings, that is said to be very effective, is being applied by the Sprayo-Flake Company of Milwaukee, Wisc. Bits of waste paper and cloth, the size of confetti, are the base of this material, which is mixed with a solution of silicate of soda or water glass, a sirupy fluid that makes an excellent binder.

The outfit used by the company to shoot this composition in place is compact and portable, and consists of a specially designed spray gun and a gasoline motor that drives a dynamo and a small air compressor. Besides furnishing current for lighting where electricity is not available in buildings under construction, the dynamo operates an air pump that feeds the loose flakes to the gun, while the compressor provides the air that adds the liquid binder and sprays the resulting mixture against the surfaces to be protected by this method of insulation.

As one of the accompanying illustrations shows, the light, fluffy material is forced through a jointed pipe and a length of flexible hose to the gun, where it is mixed with the silicate of soda entering at that point by way of two feed lines. These feed lines terminate in two nozzles, one on each side of the gun, through which the strongly adhesive composition is forcibly discharged in the form of a spray. Walls, ceilings, etc., can thus be quickly given a coating of "Sprayo-Flake" ranging in thickness from half an inch to the full depth of the studding. Once dry, coatings of this description are hard and permanent and, because of the thousands of air cells contained in the fibrous mass, are said to possess excellent insulating properties.



These walls have been insulated with a 1-inch layer of "Sprayo-Flake".

NITROGEN SAVES WEIGHT IN SHIPPING TRANSFORMER

A TROUBLESOME situation arose not long ago at the Sharon, Pa., plant of the Westinghouse Electric & Manufacturing Company, when it was found that the usual method of shipping transformers could not be followed in the case of a large unit destined for Oakland, Calif. Transformers usually leave the works filled with oil which, in this instance, would have meant so much more weight that the shipment could not have been handled at the receiving end. On the other hand, without the oil, it would have been necessary to thoroughly dry out the transformer upon its arrival at Oakland, and this would have involved not only delay but much expense. As a result, a new and entirely satisfactory method has been worked out that greatly lessens the weight of the unit in transit.

According to *Power:* Before the transformer was shipped it was thoroughly dried and tested. After the cover was bolted in place, dry nitrogen was blown through the tank until the oxygen content of the gas in the tank was reduced to 1 per cent. More nitrogen was then introduced until the pressure within the case amounted to 2.95 pounds per square inch at 59°F. The object of this was to keep out air and moisture. As an added precaution, a bag of calcium chloride was put in the tank to absorb any possible moisture and also to indicate its presence upon the delivery of the transformer.

When the unit reached the substation it was discovered that the tank was under a pressure of 1.5 pounds per square inch at 59°F., and that the oxygen content was 1.8 per cent. Likewise, the calcium chloride was quite dry. No time was lost in filling the transformer with oil and putting it in service. Thus, by the use of nitrogen, under pressure, it was possible to reduce the weight of the shipment by more than 32 tons.

GOLD CONCENTRATOR FOR PLACER MINING

A GOLD concentrator for use in the field has been invented which can be counted upon, so it is claimed, to do far more effective work than the miner with his pans, flumes, and ditches. The following details regarding this new aid to placer mining are taken from a recent issue of the *Pacific Coast Miner.*

The gold concentrator is built in 10- and 20-foot sizes, and is operated by a 2-hp. gas engine. The dirt is shoveled into a feeder; and a revolving screen throws out the coarse gravel and stones. Next, the dirt goes into a tank, which takes the place of the miner's pan. Three shakes of this tank, together with a circulation of compressed air through the riffles, tend to settle the ore. Drag chains are then used to carry off the light sand, while the gold, platinum, and other values are swept into an ore valve and dropped into a pan where mercury completes the separation process.

A hand cream has been placed on the market by the merchandizing department of the General Electric Company that was developed in that concern's research laboratories for certain of its own men as a protection against skin discoloration and irritation that might lead to infection. When applied to the hands and arms before beginning work, the cream is said to form an invisible film that effectually prevents oil, grease, dirt, varnish, paint, etc., from penetrating the pores. Washing in warm water quickly removes the film, thus leaving the skin in a clean and healthy condition.

Barre's Gray Granite Rightly Famous

The Beautiful and Enduring Stone is Produced in Great Quarries Centered on This Alert Vermont City

PART I

By R. G. SKERRETT

BARRE, a bustling city of 15,000 inhabitants, lies in the picturesque Vermont hills east of the towering Green Mountains. Barre is known the world over as the center of the granite industry of the United States; and Barre granite stands pre-eminent because of the characteristics that make it especially superior for monumental work.

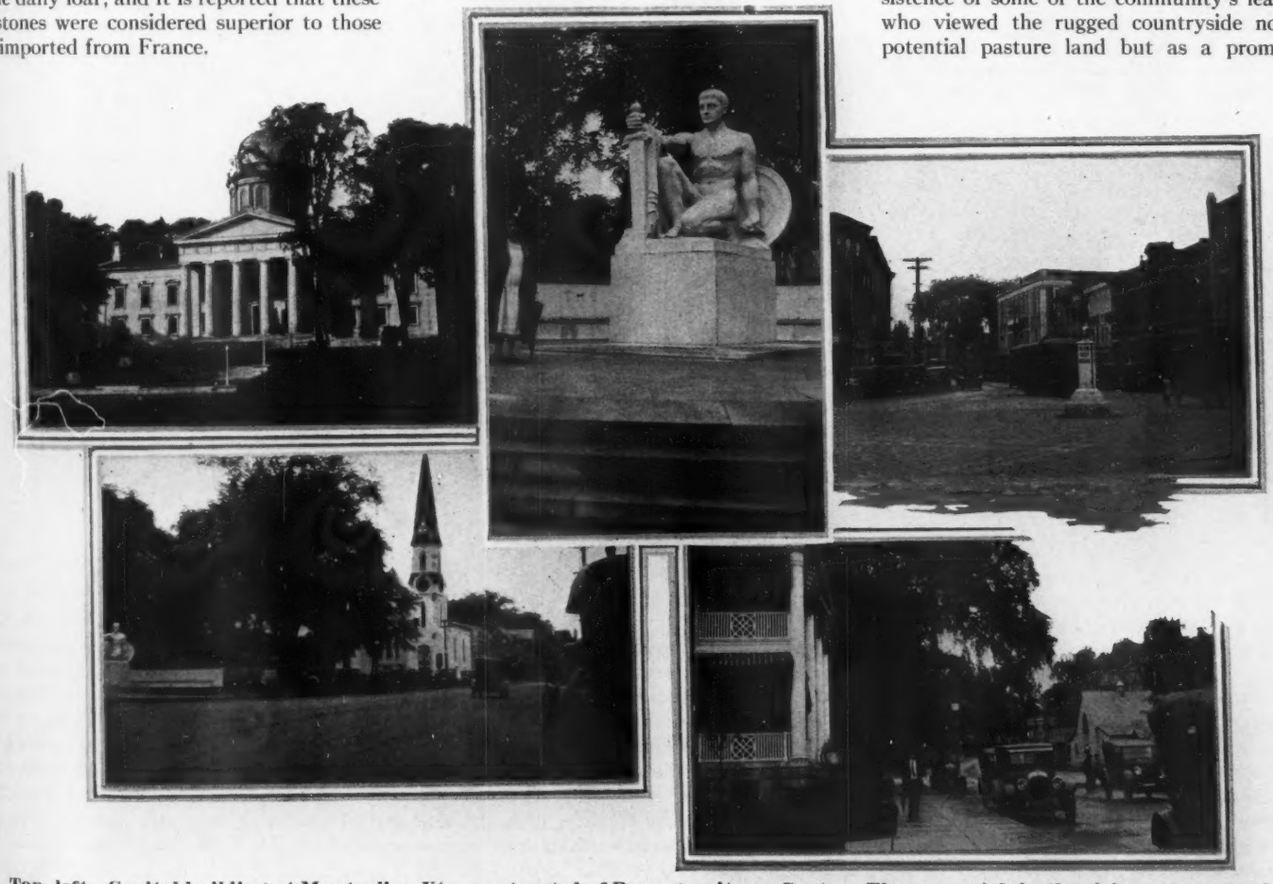
It is interesting to recall that the Indians, who roamed the region before the coming of the white man generations back, discovered in the granite outcroppings in the neighborhood of present-day Barre stone highly suited for working into arrowheads, spearheads, battle axes, etc. Later on, to be exact about 1780, the white settlers in that part of Vermont discovered that granite from the near-by hills made excellent millstones; and in the course of time one of these hills in particular became known as Millstone Hill because it was the principal source of the needful raw material. Millstones from granite quarried there were used far and near in grinding grains for the daily loaf; and it is reported that these buhrstones were considered superior to those then imported from France.

THE story of Barre granite is, first, a story of nature's abundance locked in the neighboring hills and, then, a record of difficulties successively overcome in getting the riches out of the ground and in moving them thence to far-flung markets.

Early quarrymen were hampered by primitive means of transportation and equally inadequate tools with which to break the rock loose. Today, Barre has modern rail lines that take the granite right from the quarries; and air-driven rock drills and other pneumatic equipment are available. Stone is now being got out at a rate that was once deemed impossible.

Even while the millstone industry flourished in Barre, the pioneer settlers found the available granite useful for door steps, for fence posts, and for the underpinning of buildings. The manner in which the stone withstood exposure to the rigorous winter weather of the region suggested its employment in still other ways—particularly to commemorate the deeds of departed heroes or to serve as enduring reminders of relatives that had passed on. In fact, the larger part of the granite now quarried in the Barre district is utilized for memorial purposes. This is because of its fine grain, its pleasing coloring, and its hardness—characteristics due to the conditions under which the granite was formed during one or more convulsions of the earth's crust, perhaps millions of years ago.

Barre granite, in spite of its excellent physical properties, would not have attained widespread recognition as the standard for gray granite for monumental use had it not been for the farsightedness and the sturdy persistence of some of the community's leaders, who viewed the rugged countryside not as potential pasture land but as a promising



Top, left—Capitol building at Montpelier, Vt., constructed of Barre granite. Center—The memorial, in the civic center, reared by Barre to her fighting men in the World War. The remaining pictures are snapshots of Barre's busy streets.

source of an enduring structural material. Success was won in the face of a record of many failures, and only after setbacks that would have dismayed or effectually discouraged most people. The enviable position now enjoyed by Barre is, in itself, a monument to energy, enterprise, and efficiency—triple forces well calculated to surmount most obstacles that may block the path of progress.

Millstone Hill, known familiarly by the people of Barre as "The Hill", lies about three miles back of the town and rises to a height of more than 1,000 feet above the civic center; and it is upon this eminence that some of the most spectacular quarries in the district are situated. The position and the altitude of the hill seriously hampered for years the commercial development of those granite deposits, because the stone could be moved thence to the market only by slow and toilsome hauling—teams of horses and plodding oxen doing most of the work.

Before describing how granite is now quarried on the hill it would not be out of place to outline what geologists are generally agreed is the probable origin of Barre granite. Their assumptions and conclusions picture for us how the granite beds had their birth; and the findings of those experts make it understandable why Barre granite is distinctly superior for some services. In short, the stone's texture and durability are the consequence of the intense stresses to which the granitic mass was subjected when passing from the molten to the solidified state.

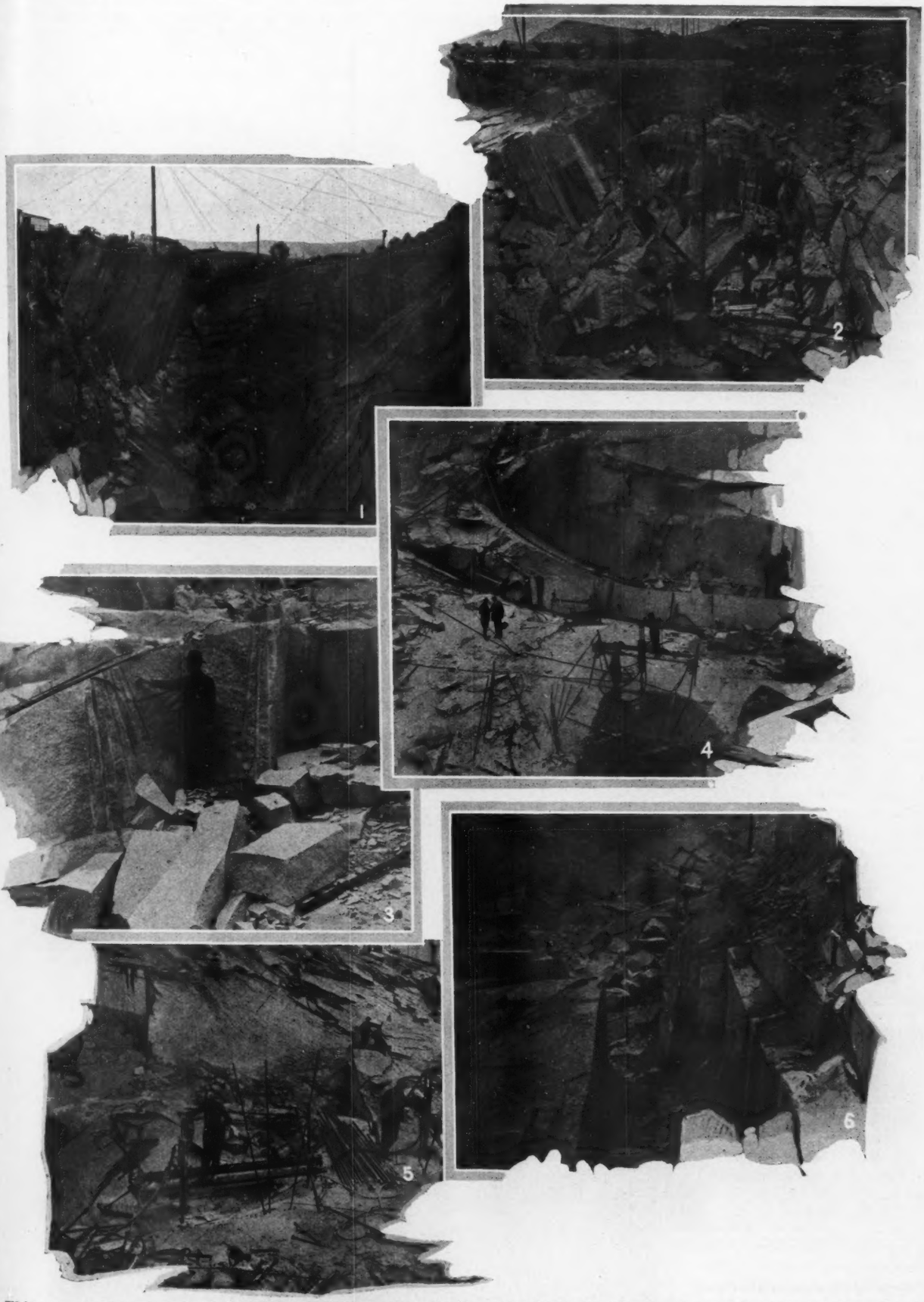
Untold eons ago, when a sea covered much if not all of what we now call Vermont, the sedimentary rock of that sea bed was shoved up to the light of day, forming a great ridge that now survives as the Green Mountains. This folding opened cavernous channels into which molten plasma was forced upward from the bowels of the earth. This plastic, glasslike matter, while at a dull red heat, was exposed to opposite pressures—that of the weight of the overlying sedimentary rock, possibly hundreds of feet thick, and of the irresistible thrust of subterranean forces. So titanic was the net effect of these opposing pressures that the molten granite was driven into narrow transverse and longitudinal fissures in the adjacent schist and slate before the plasma cooled and solidified. The fact that a vast blanket of sedimentary rock overlay the molten granite prevented it from reaching the surface; and this covering served as an insulator that caused the plasma to cool and to crystallize slowly. In other words, instead of becoming a great body of glass as the result of rapid cooling, the mass was transformed into a granite of the density and the grain that now distinguish Barre granite from the general run of such rock.

In many places a thin capping is all that now remains of the erstwhile rock which once

In a cutting yard where large and somewhat irregular blocks of granite, from a nearby quarry, are drilled with lines of shallow holes and then split to desired dimensions with steel plugs and feathers.

furnished part of the pressure needed to form the granite. This is an indication not only of the age of the granite but of the long period of time that has intervened since glacial action and weathering began to wear away the superposed rock, hundreds of feet thick.

The most abundant and the most conspicuous mineral usually found in granite is feldspar. Feldspar, quartz, and mica determine to a large extent the general color of the rock; and, by reflecting light, the feldspar imparts brillancy to the granite. The quarries on Millstone Hill at Barre yield two kinds of



1—This quarry, the property of the Wetmore & Morse Granite Company, is 200 feet deep. 2—Looking into the cavernous pit of a quarry operated by the Wells & Lamson Quarry Company. 3—Lewis holes, loaded with black powder, are sometimes used to break loose great masses of granite. 4—Channeling with F-24 piston drills mounted on quarry bars. 5—Channeling with X-70 drills mounted on quarry bars. 6—Close-up of the walls of two channel cuts, 12 feet deep, made to get out key blocks from a solid floor of granite.

Left—One of the numerous openings on "The Hill." Right—A mountain of waste granite that is continually growing.

granite, known to the trade as "light" and "dark". The dark variety, especially, takes a high polish, and is therefore commonly preferred when the stone is to be so finished. Either one lends itself admirably to carving; and extremely beautiful examples of the granite cutter's art are produced continually in the finishing plants, in Barre, where an army of skillful workers is employed.

But despite nature's bounty in the form of vast beds of superior granite, Barre might have continued to be a village little known to the world at large had not the Central Vermont Railroad extended its tracks from Montpelier to Barre in 1875. That put Barre on the map of steam transportation, and gave the local quarries an easier outlet for the stone when once it had made the slow and difficult journey down the steep hill to the town. The really large pieces, weighing a number of tons, made this descent on wooden rollers that were often crushed by the weight upon them and not infrequently mired when the ground was wet or soft. At times, to prevent these granite blocks from sliding too fast on the sharpest grades, it was necessary to hold them in check with restraining teams of horses pulling in the opposite direction. On the other hand, the teams had to tug and to strain to move the blocks forward on level or gently sloping stretches.

After arriving in Barre, the pieces of granite were mounted on trucks to which numerous horses or oxen were hitched to haul the stone to railhead at Montpelier, about seven miles away. The capitol at Montpelier was built of Barre granite in the latter "thirties", and all the stone for that purpose was carried there in the manner described. The State of Vermont paid John Wheaton, the owner of one of the quarries near Barre, the munificent sum of $100 a year for the stock needed in rearing that imposing structure—the state doing the quarrying. That was before Barre granite had come into its own and the price of that stone had mounted to where it now stands.

The linking of the district with the outside world by the extension of the railroad from Montpelier altered greatly for the better the problem of transportation as well as the widening of the market for Barre granite. But, even with this improved facility, there still remained the tedious and at times dangerous task of getting the granite blocks from the quarries down to the waiting freight cars in the village. This situation continued until 1889, when what is popularly known as the "Skyline Railroad" was built from Barre up Millstone Hill. It consisted of a system of switchbacks that enabled a locomotive to climb the smooth rails and to draw up a maximum of ten empty flat cars. That road, originally 5 miles long, has gradually been extended to 30 miles, and now traces its winding course in and out among the various quarries. The completion and the expansion of that line may properly be said to mark Barre's longest stride forward, inasmuch as it makes it possible to move quickly to the quarries essential supplies and machinery and, in turn, to carry away rapidly pieces of granite ranging in weight from less than a hundred pounds to ponderous blocks totaling scores of tons.

There are eight large quarries on the hill, or, to be exact, in the hill, because some of these great cavernous pits are fully 200 feet deep. This fact gives us an indication of the vast volume of plasma that was forced upward to form the existing beds of igneous rock. Exploratory drilling has penetrated much deeper in places without reaching the underlying limits of the granite. The magnitude of these beds of exceptionally fine gray granite makes it understandable how it is possible to remove from them great blocks for pedestals, for tall columns and monumental shafts, and for other impressive purposes.

In some cases, the detached masses of granite are so big that they have to be drilled and split on the quarry floor before they can be lifted to the ground level. Probably the largest single mass ever broken free in a Barre quarry was one that was 200 feet long, 80 feet wide, and 24 feet thick. It weighed about

Vistas of the countryside seen from the top of "The Hill."

35,000 tons; and, when cut into blocks of different sizes, produced enough marketable stone to fill substantially 1,730 flat freight cars. When it left the quarry, that granite had a value of quite $1,500,000.

Manifestly, all these big quarries are equipped with up-to-date mechanical facilities both for detaching the granite blocks from the primordial ledge and for lifting and placing the rough pieces where they can be either loaded directly upon waiting freight cars or landed in the cutting yard which is associated with each quarry. In the cutting yards, the blocks are split and roughly formed to prescribed dimensions for shipment thence either to granite-manufacturing plants or cutting sheds in Barre or to distant points for working into final form.

The workmen in the quarry cutting yards are perfectly familiar with the physical characteristics of the granite, and know how to use their expert knowledge of the grain of the stone to split the pieces into the required dimensions. To the uninitiated it is amazing what these men can do by drilling a succession of shallow holes into which they insert steel plugs and wedges which, when hammered successively to just the right extent, will produce a split or cleavage, in a chosen plane, from side to side or from top to bottom of a block of granite.

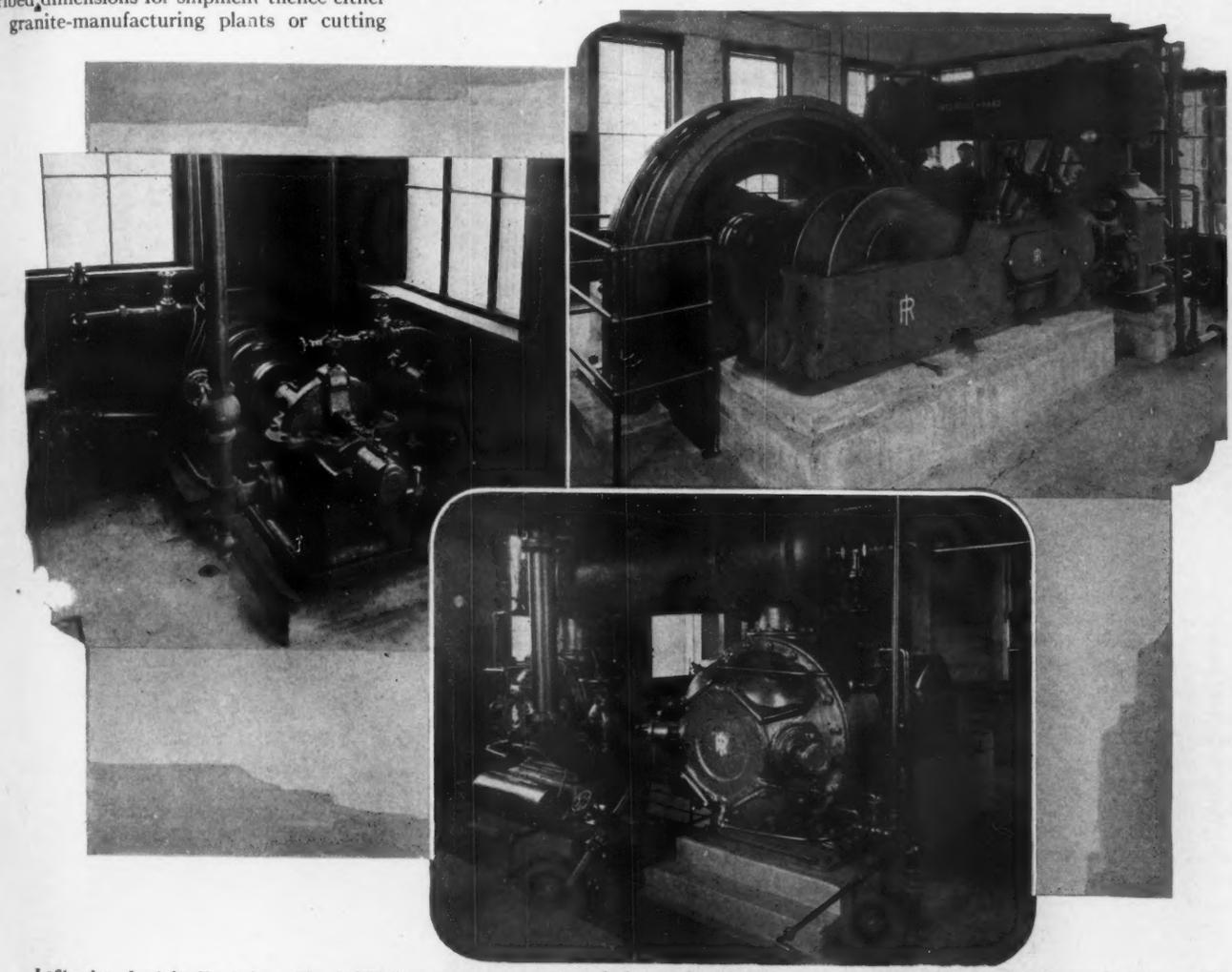
Inasmuch as Barre granite is utilized for special purposes because of its excellence, the quarryman must often remove a great deal of stone that cannot be marketed in order to obtain enough granite of the desired standard and dimensions; and in some cases this wastage —representing seemingly profitless work— runs as high as 85 per cent. That is to say, for every ton of marketable granite nearly 6 tons of additional and unsalable rock may have to be quarried. A fair average might be expressed as 50 per cent waste and an equal amount of marketable granite. Bearing this in mind, we shall be the better able to grasp the significance of the following figures dealing with last year's production of monumental granite in the Barre district.

During 1927, the quarries had an output of rough stock totaling 193,911 tons; and there was shipped out of the district in that interval 48,477 tons of rough stock that was worked up or finished elsewhere. The difference between the two foregoing figures represents the volume of granite manufactured or put into final shape by the local cutters and carvers. This phase of the subject will be dealt with later on, after we have described, in some detail, the means and the methods primarily employed to detach blocks or masses of granite from the great beds that were molded in the remote past when the Green Mountains were towering ridges of bare rock newly heaved above the surface of a vast inland sea.

(*To be concluded.*)

For cleaning stove, nut, pea and slack coals, ranging in size from 2¾ inches to 0 inch, the New River & Pocahontas Consolidated Coal Company has lately had installed at its New-hall Mine a pneumatic coal-separating plant having a capacity of 200 tons per hour. This is the second of its kind to be placed in operation at that colliery during the year for the treatment of coal of the sizes mentioned.

The two plants embody the latest system of dust collection and air filtration which, according to the *Mining Congress Journal*, does not permit the escape of any dust-laden air to the atmosphere, thereby overcoming one of the early objections to this method of coal cleaning.



Left—An electrically driven No. 2 DV Cameron pump that delivers circulating water to a 2,000-foot PRE-2 compressor on the property of the Wells & Lamson Quarry Company. Right—This PRE-2 compressor furnishes air for operating rock drills in an opening of the Wells & Lamson Quarry Company. Bottom—A 1,300-foot PRE-2 compressor in service on the property of the Wetmore & Morse Granite Company.

SECOND INTERNATIONAL COAL CONFERENCE

BETWEEN sixty and seventy scientists and fuel technologists in eleven different countries, it is announced, have tentatively accepted invitations to speak at the Second International Conference on Bituminous Coal, which is to be held at the Carnegie Institute of Technology, in Pittsburgh, Pa., during the week of November 19, 1928.

The purpose of the coming congress, like the earlier one, is to present the results of recent studies of coal that have to do with improved methods of utilization and combustion. The program will include discussions on low-temperature distillation, high-temperature distillation, coal-tar products, power, smokeless fuel, complete gasification of coal, hydrogenation, pulverized fuel and its new applications, fixation of nitrogen, coal beneficiation, etc.

Dr. T. S. Baker, president of the institute, has expressed the opinion that the second conference will be much larger in scope than the first one, and that the number of delegates from foreign countries will be considerably in excess of that at the 1926 meeting, when thirteen nations were represented.

AN AIR-HOIST TESTER

UNDER the heading *Ideas from Practical Men* there appeared in a recent issue of *Power* the following letter from E. J. Jordan, of Long Beach, Calif. The subject dealt with by him is one that should be of interest to a wide circle of our readers, because air lifts are now so extensively employed in industry generally.

"Air hoists are often expected to hoist more than they were designed for. To prevent this and to assist the repairman, the brake tester shown in the sketch was designed.

The brake band and the adjusting screw, belonging to the hoist, are swung around a quarter of a turn from the normal position, and the screw is fitted with an extension point to bear on the end of the lever.

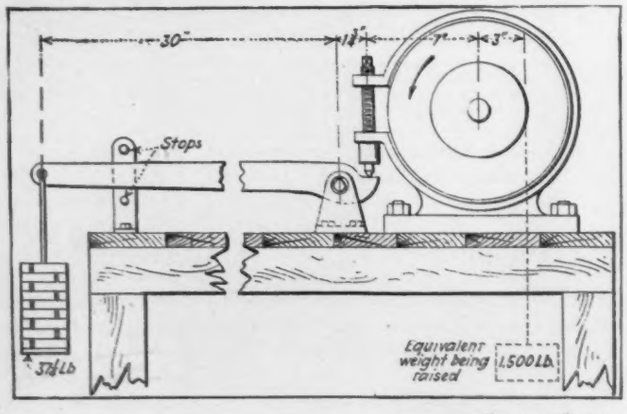
With a pressure gage to show the air pressure at the time of the test, a test should be made when the hoist comes in for overhaul, and another after the hoist has been repaired. The preliminary test will decide its condition and the probable amount of overhaul required.

To make the test, all that is necessary is to start the hoist with no load and to adjust the brake and the weight on the end of the lever until the hoist indicates that the limit has been reached.

To find what each pound hung on the end of the lever is equivalent to in pounds raised by the hoist drum, it is only needful to know the ratio of the movements of the end of the lever to which the weight is attached, and a point on the drum periphery.

The ratio of the long and short ends of the lever is $30 \div 1.75 = 17.2$, and the ratio of the radius of the drum and the radius of the center line of the adjusting screw of the brake band is $7 \div 3 = 2.34$, and the combined ratio is $17.2 \times 2.34 = 40.24$ to 1.

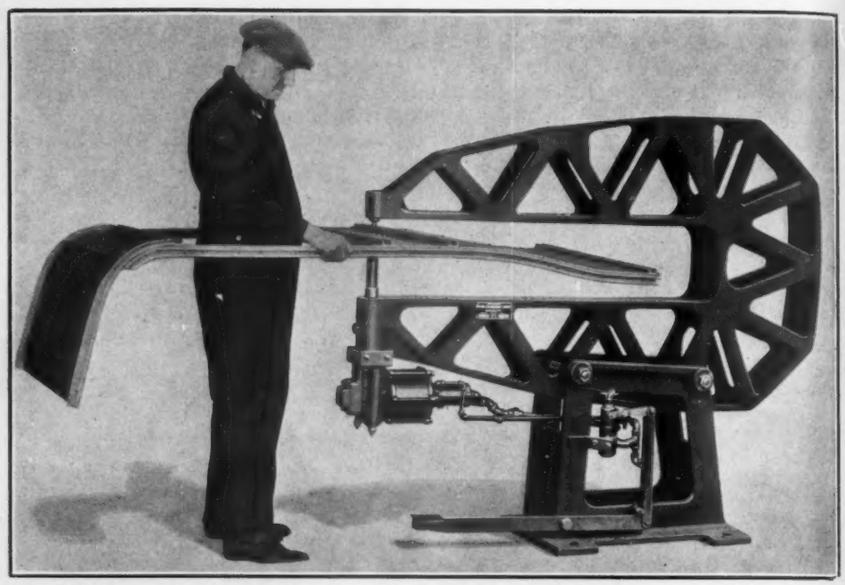
One pound hung on the end of the lever will be equal to 40.24 pounds hung on the drum. With 37¼ pounds hung on the end of the lever and the lever against the top stop, the hoist is then doing work equivalent to raising a load of 1,500 pounds. The brake horsepower generated will be the speed of the drum periphery in feet per minute, multiplied by 1,500 and divided by 33,000."



Courtesy, Power

Arrangement of the air-hoist tester.

Uruguay, though comparatively small in area, is of considerable commercial importance. Excepting Argentina, her per capita foreign trade, under normal conditions, is larger than that of any other South American country.



This stationary type of the new Hanna riveter drives ¼-inch duralumin rivets and heads them on the underside.

SPECIAL PNEUMATIC RIVETER FOR DURALUMIN RIVETS

AS the result of the ever-increasing use of duralumin in the construction of aircraft and automobiles, there has been produced, by the Hanna Engineering Works, a pneumatic riveter designed especially to bind duralumin parts with duralumin rivets. The riveter is offered in a wide range of sizes and in either a stationary or a portable form—the machine illustrated having a reach of 48 inches, a gap of 10 inches, and a die stroke of 1½ inches. When operated with air at 100 pounds pressure it is capable of driving rivets ¼ inch in diameter, and develops ram speeds up to 60 strokes per minute.

According to the manufacturer, the pressure exerted by the ram is predetermined; and as this pressure is uniform throughout a considerable portion of the stroke it assures perfectly driven rivets regardless of variations in the thickness of the parts being riveted. The construction of the machine is such that rivets may be inserted in the holes well in advance of their actual driving—making its operation nearly a continuous one. The release of the air is effected by a movement of the foot, leaving the workman's hands free to shift the work.

An aerial cableway has been opened to traffic in Switzerland that outclasses anything else of the kind in that country where funiculars and cableways are widely used in the transportation of passengers and freight. The new line extends from Gerschnialp to Truebsee, high up in the Alps, and was designed primarily to make that lofty region accessible for skiing and other sports during the winter season. The stations are 7,332 feet apart, with a difference in elevation of 1,745 feet. Traveling at the rate of about 9 miles an hour, the cableway has a carrying capacity of 65 passengers and 1,320 pounds of freight in each direction every 60 minutes.

American Rock Drills Aid in Building Big Power Station on Rhine

By A. van der PLAS

SWITZERLAND is taking steps to make further use of the energy of the descending waters originating in the snows and the glaciers of her scenically wonderful mountains. Indeed, the industrial future of Switzerland, the continued well-being of many of her productive activities, are largely dependent upon the utilization of her priceless asset, the "white coal" of her tumultuous rivers and streams.

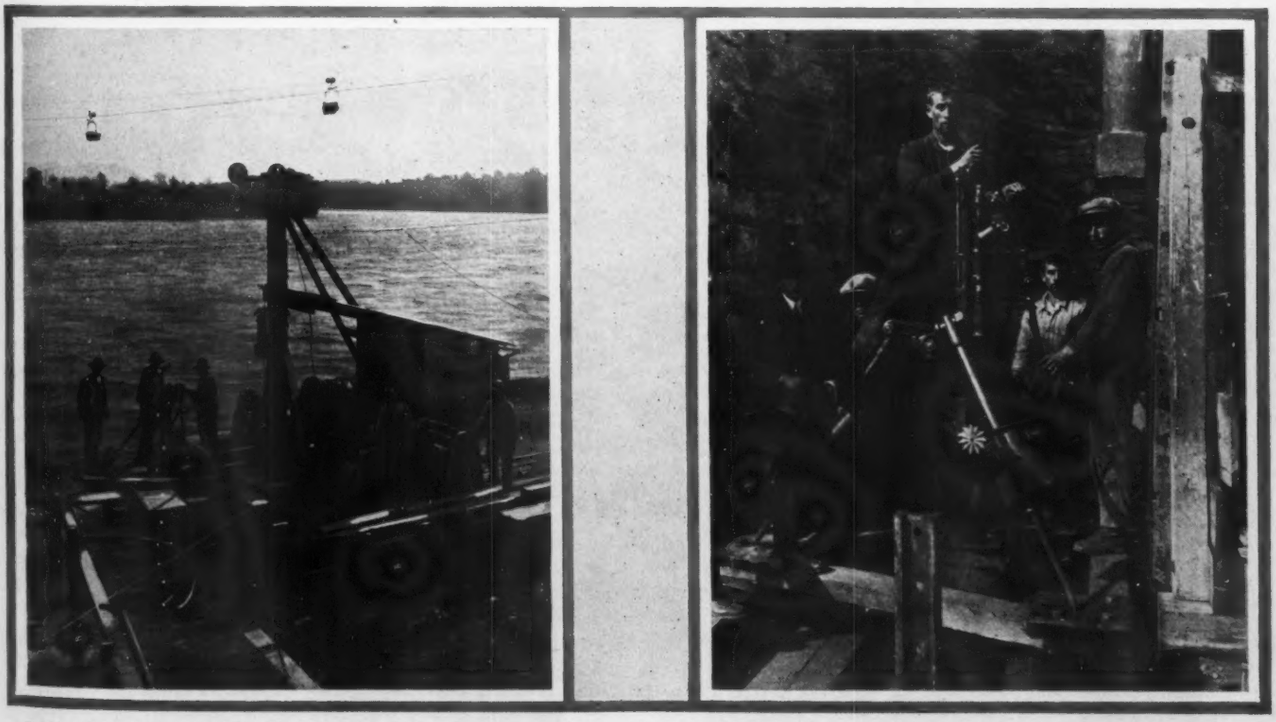
Switzerland must have a wider and a more profitable market, and she can have this only by making goods for export at a price that will permit her to compete abroad with other countries. Switzerland has to import nearly all her raw materials; transportation rates within her borders are far from low; and her wage scale is generally higher than that of any other European country. Happily, Switzerland is blessed with an abundance of capital, with skillful technicians and artisans; and, what is equally important, with a virtually inexhaustible supply of cheap water power. Swiss economists recognize that the nation must utilize to a much larger extent her hydro-electric potentialities. And, what is very much to the point, Swiss enterprise is bent upon this.

Comparatively small as Switzerland is, measured by the standard of square miles, still her railways have to contend with the serious problem of widespread and generally heavy grades, necessarily limiting the number of loaded cars that can be pulled up hill and, correspondingly, the volume of profitable freight that can be hauled for a given expenditure of motive power. Incidentally, the speed is reduced in climbing these grades. It was to overcome this situation that the Swiss Government undertook the wholesale electrification of the Federal Railways, that is now nearing completion. In 1919, the government lines were electrified for 66.45 miles, and by the close of the present year the electrification of the Federal Railways will total 1,034.59 miles. In addition to this, 2,049.3 miles of secondary roads will then be operated by electricity—making a total of 3,083.89 miles or substantially two-thirds of the country's entire rail system.

At the present time the per capita use of electricity in Switzerland is greater than that of any other European country. The reason for this is the very low rate at which current can be generated, distributed, and sold at a profit. In many ways, electricity has revolutionized the social as well as the industrial life of the republic. We mention these facts so that the reader will find it easier to appreciate the significance of another hydro-electric plant in course of construction on the Rhine at a point where there is a sufficient drop in that watercourse to provide an ample head for the effective operation of a number of big turbine-generator sets. We refer to the project now in hand at Ryburg-Schwoerstadt, a few miles above Rheinfelden, Switzerland.

Because of the international character of that part of the Rhine, the capital involved has been subscribed equally by interests in the two countries; and two state institutions and two private enterprises have joined efforts to bring about the consummation of a scheme that was proposed as far back as 1909 and was nearly agreed upon when the World War put a stop to negotiations. Consideration of the project was revived five years ago; and final arrangements were made in the fall of 1926, when the Kraftwerk Ryburg-Schwoerstadt A.-G. was organized to build the necessary dam and power house, with essential associate features.

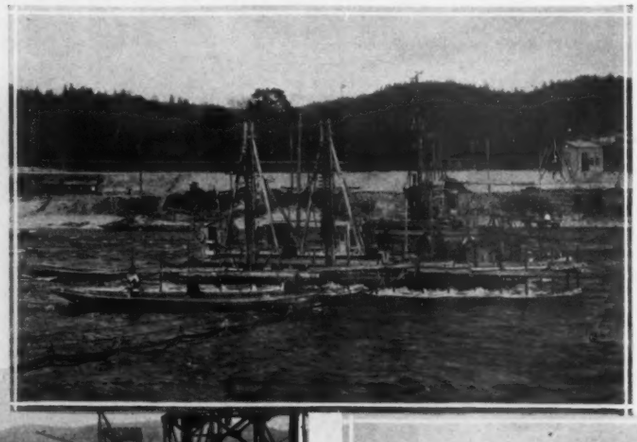
Between Lake Constance—that is, Bodensee—and Basel, the upper Rhine has a drop of about 492 feet, with an effective head of 328 feet which can be utilized in thirteen stages. The site of the Ryburg-Schwoerstadt power plant is at one of these strategic stages and a few miles upstream from Rheinfelden, which is only about fifteen miles above Basel. It might be pointed out here that the total annual power development in Switzerland during 1927 amounted to about 3,820,000,000 kw-hrs.; and it is authoritatively estimated

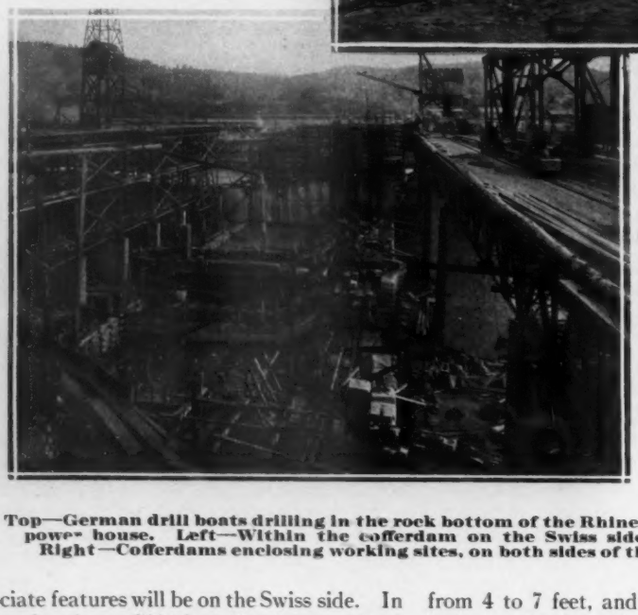


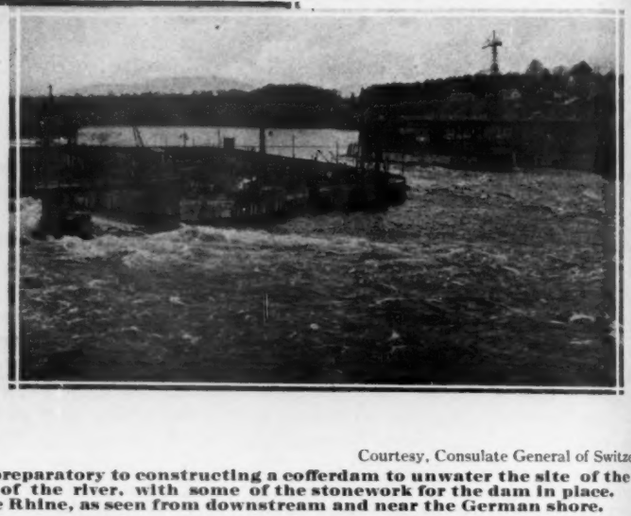
Left—Drill boat, equipped with an X-71 drifter mounted on a tripod, drilling holes in the rock underlying the bed of the Rhine. Right—Close-up of an X-71 drill and the rosette bit used on the drill steel. Note the tube in which the drill steel works.

that the waters of the upper Rhine are capable of producing yearly more than 3,000,000,000 kw-hrs. The Ryburg-Schwoerstadt hydro-electric station is only one of several under contemplation.

The Ryburg - Schwoerstadt plant will consist of a reinforced-concrete dam of conventional form, with the spillway and the power house placed along the same longitudinal axis. The power house will be on the German side of the river while the spillway and the







Courtesy, Consulate General of Switzerland

Top—German drill boats drilling in the rock bottom of the Rhine preparatory to constructing a cofferdam to unwater the site of the power house. Left—Within the cofferdam on the Swiss side of the river, with some of the stonework for the dam in place. Right—Cofferdams enclosing working sites, on both sides of the Rhine, as seen from downstream and near the German shore.

Pieces of gravel even larger than a man's fist were thus discharged from the tube. After blowing out the steel tube was rammed deeper into the water bed, blown again with compressed air, and the procedure continued until solid rock was reached.

The net drilling time for a hole of from 4 to 7 feet deep was about twenty minutes; and the shortest period was thirteen minutes for a 6-foot hole. Setting and ramming the enveloping tube, blowing out the holes, and shifting the drill boat after every two holes

associate features will be on the Swiss side. In the station there will be installed four turbines, each of which will be capable of developing 35,000 hp.; and from 8,829 cubic feet to 10,594 cubic feet of water will pass through each turbine per second. The intake pipes of the turbines will be large enough for a mounted man to ride through them. Inasmuch as the Rhine is navigable above the Ryburg-Schwoerstadt plant, the dam has to be provided with locks to facilitate the movement of river craft.

Work on the undertaking was begun during the winter season of 1926-27; and the plan is to have the station in operation by the end of 1931. The contract has been divided equally between German and Swiss concerns—the work on the German side of the river having been awarded to the firms of Gruen & Bilfinger and P. Holzmann & Company, and that on the Swiss half to Locher & Company and J. J. Ruegg.

The dam is being built, as is usual, in sections; and, as a preliminary, the Swiss contractors constructed a cofferdam extending from the Swiss shore out into the Rhine for 200 feet and then turning downstream a short distance and thence back to the shore. In order properly to secure this cofferdam, within the protection of which operations were to be carried on, it was necessary to drill 250 holes in the river bed lying from 7 to 15 feet below the surface of the water. These holes penetrated the bottom to a depth of from 4 to 7 feet, and had a diameter of 5⅛ inches. The holes had to be drilled in two rows, 7 feet apart each way; and the workers had to contend with a stream velocity of fully 9½ miles an hour. After experimenting for a while, this part of the undertaking was pushed through to a successful completion with X-71 drills mounted on tripods. The German contractors also used these Ingersoll-Rand drills for kindred work on the opposite side of the river—the X-71's being mounted, however, on frames instead of tripods. One of our photographs shows an X-71 mounted on a drill boat that was utilized by the Swiss contractors.

The bit used for this drilling was made of high-grade hollow steel, and was provided with a taper hole into which fitted the tapered end of the drill steel. The rock is a rather soft limestone; and, accordingly, a rosette form of bit was employed. During the drilling, compressed air was blown down through the hollow steels to agitate the water and to wash away the cuttings. There is much gravel on the river bed of the Rhine, especially along the shore, which made drilling somewhat difficult. To offset this, a steel tube, 8 inches in diameter at the top and 6 inches across at the bottom, was guided down alongside the drill boat, between I-beams, and forced into the bottom as far as possible. Next, a 1¼-inch pipe, to which two 1-inch hose lines were connected, was used to blow out the gravel. took up most of the time; but from five to six holes were drilled per drill during each 9-hour shift. The purpose of the holes was to provide lodgments for steel rails, tied together with steel plating and further unified by means of wooden sheet piling and concrete to form bulwarks strong enough to resist the onrush of the river currents. As soon as a hole was drilled, a rail was driven into it. When the bulkhead or cofferdam was completed, the enclosed space was pumped out.

On the German side of the thread of the stream, the river bed is cut by a channel, nearly 100 feet wide, that extended to a depth of approximately 33 feet below the bottom of the Rhine. Owing to swift currents, considerable difficulty was experienced in sealing that hole when building the necessary enveloping cofferdam.

Due to variations in the flow of the Rhine at different seasons, it is computed that the amount of power developed will range between 30,000 and 90,000 kw.; and, based upon records for the last two decades, it is believed that the annual output will average 650,000,000 kw-hrs. With the cost of construction put at 60,000,000 francs, current can be sold for 1.4 centimes per kilowatt-hour. Assuming the franc to be worth 4 cents, the price per kilowatt-hour would be equivalent to $0.0056. At this rate, current so produced could compete with power generated with brown coal in the south of Germany.

Mile-Long Tunnel Drains Ojuela Mine

By F. E. BRUHN and F. P. CLEARY

THE Compañia Minera de Penoles, S. A., has recently completed, in a little more than eight months' time, the driving of the Ojuela Drainage Tunnel at its Ojuela unit near Mapimi, in the state of Durango, Mexico. This tunnel is 5,200 feet long; is 9x8 feet in cross section; and follows a straight course with a grade of approximately 1 foot for each 100 feet of length. The Ojuela Tunnel was planned and built for the purpose of completely draining the present mine workings by gravity, thus doing away with the need of pumping which, in the past, has involved heavy expenditures.

For the most part, the tunnel was driven through comparatively easy-drilling rock—the first 1,400 feet being in thin-bedded, fairly soft shale, and the remainder in blue lime, which is brittle and offers little resistance to rock drills. Some watercourses and hard dikes, however, were encountered, and these at times slowed up the speed of advance. The walls and the back of the tunnel are solid throughout, and required no timbering or reinforcing.

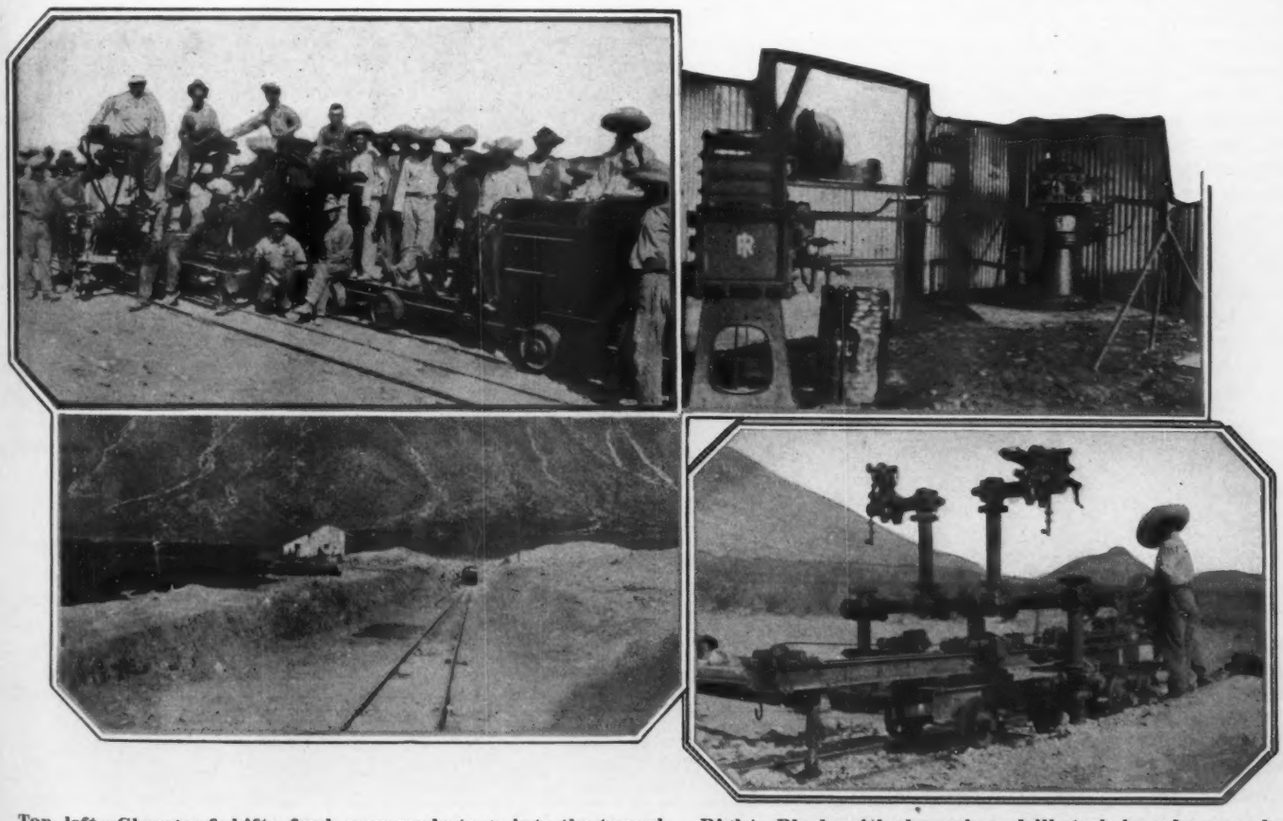
The work of drilling was done with Ingersoll-Rand N-72 drifters. Four of these—two above and two below—were mounted on a drill carriage of the type so successfully used on the Moffat Tunnel job. Connected to this drill carriage was a tender on which were mounted an air-line manifold, an air-line lubricator, and a ventilating suction fan operated by an air motor. This trailer was designed by G. W. Hezzlewood, a well-known tunnel contractor from Utah, who was in charge of construction. In addition to the equipment already mentioned, the tender carried the necessary drill steels and two extra N-72 drifters.

The drill carriage was run on tracks right up to the working face, where it was securely fastened and jacked against the wall preparatory to beginning the drilling of a round. Drilling was started by all four drifters; each drill being operated by one native machine man and a helper. Each of the two N-72's mounted on top of the carriage put in one 10-foot hole and seven 8-foot holes, while those below the carriage drilled one 10-foot and four 8-foot holes. One of the accompanying diagrams illustrates the type of round that was extensively employed and that proved so satisfactory on this project. After each round had been completed, the carriage was moved back a safe distance to a siding, where all the drills were inspected, tested, and lubricated thoroughly.

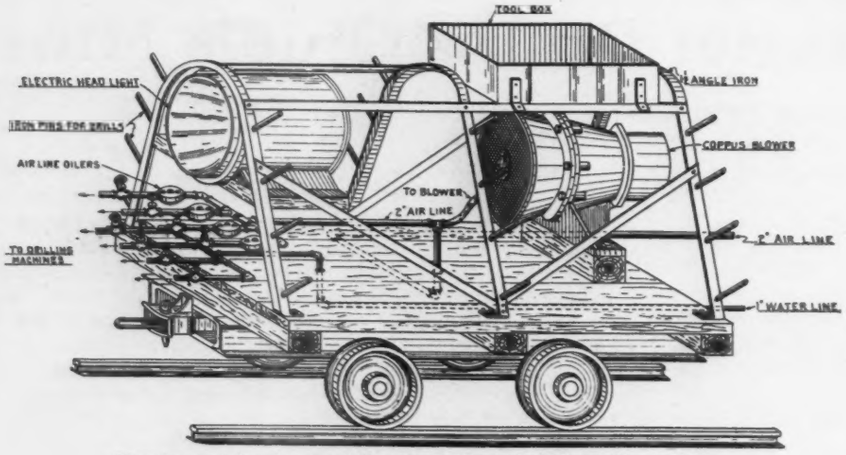
Sets of steels were used, with 2½-foot changes, ranging in length from 2½ to 10 feet. These were made of 1¼-inch, hollow, round Ingersoll-Rand Swedish steel, and were equipped with standard 4-point, 14 and 5 degree taper cross bits and standard "Leyner" lugged shanks. The bits were of 2-, 1⅞-, 1¾-, and 1⅝-inch gage. The drills were driven with air at 90 pounds pressure; and 40 per cent dynamite, manufactured in Mexico, was employed to do the blasting—an average of 65 pounds being required for each round. The air-line lubricator on the trailer, which was in the nature of an experiment, served to oil the N-72 drifters.

The work of mucking was performed by two Butler mechanical loaders —one serving as a spare. These machines were operated with compressed air and gave satisfactory service. Four 2-ton side-dump cars, hauled by a storage-battery locomotive, removed the excavated material. The system of tracking utilized on this job did much to speed up mucking. In other words, while four empties were being loaded at the tunnel face, four other cars that had just been filled were on their way to the tunnel portal for dumping. This was made possible by a special portable switch, which is shown in one of the accompanying diagrams.

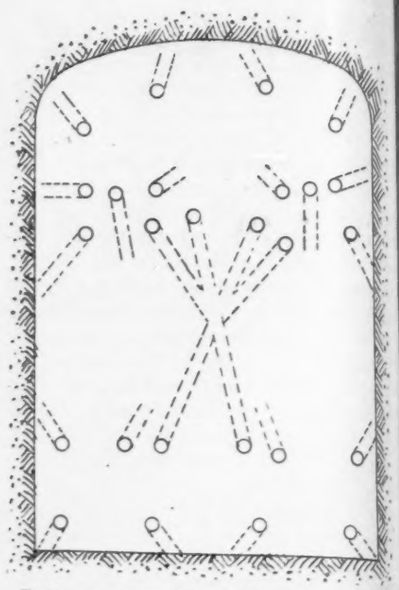
Work on the project was started on March 21, 1927. The first ten days were spent in ex-



Top, left—Change of shift: fresh crew ready to go into the tunnel. Right—Blacksmith shop where drill steels have been made fit for work in the Ojuela Tunnel. Bottom, left—Portal of tunnel at base of the mountain. Right—Type of drill carriage used in driving the Ojuela Tunnel.



Hezzlewood tender used in connection with the drill carriage.



Drill round used in driving the Ojuela Tunnel.

cavating an open cut leading up to the tunnel portal. Actual tunneling operations were not begun until May 1; and it was not until the 28th of that month that machine drills were put in use—the first 306 feet of advance having been made by hand drilling. In June, with 17 or 18 holes per round, a total of 615.5 feet of tunnel was driven through soft and medium rock. Drilling from 18 to 20 holes per round, and working in shale, the runners increased that footage during July by 174 feet, making all told 789.5 feet. The following month progress was slowed down by reason of numerous obstructions in the form of watercourses and hard dikes—an advance of only 601.7 feet being made in shale with from 20 to 26 holes per round. Then the formation changed: the rock penetrated was much harder than any previously encountered. This accounted for a footage in September of about 600 feet. December proved to be the record month, when 1,001 feet of tunnel was driven; and on January 3, 1928, just eight months and two days after the beginning of operations, the drill runners holed through. This was a very good showing, especially when it is considered that the working force, with the exception of three shift bosses and the tunnel foreman, consisted of native labor.

The men worked in three 8-hour shifts, each of which was made up of one drill-carriage boss, four machine men and four helpers, one tool nipper, one track and pipe man, one motorman and helper, two dump men, and one compressor man, all in charge of an American shift boss who, besides, operated the air-driven shovel. The crews were relieved at the face—that is, the new shift took up the work where the preceding shift left off, regardless of whether mucking, drilling, or blasting was going on.

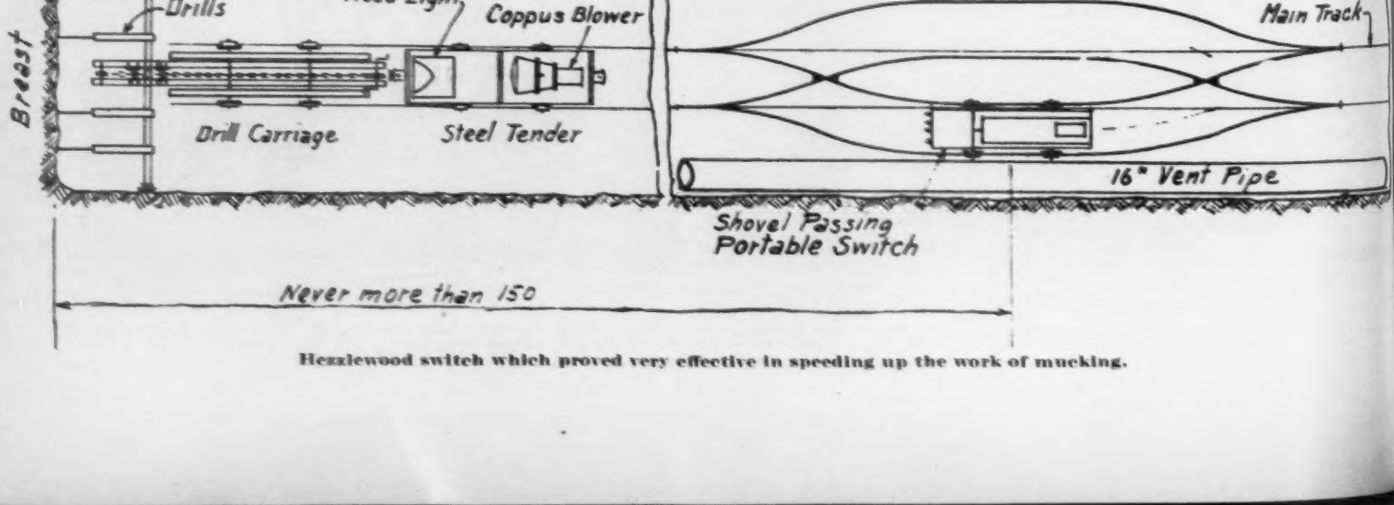
The average drilling time per round was about 1¾ hours; approximately 30 minutes were allowed in which to load and to shoot the holes; and something like 1½ hours were consumed in mucking, not including a period of half an hour needed to clear the heading of smoke after blasting. Expressed in percentages, the total time required for the different operations was divided up as follows: Setting up, drilling, and blasting, 44.9 per cent; mucking and cleaning up, 37 per cent; and waiting for smoke to clear, laying track, pipe, etc., 18.1 per cent.

The blacksmith shop was equipped with a No. 50 "Leyner" sharpener, with a shank and bit punch, and with a No. 25 oil furnace, and worked on an 8-hour shift. The gang consisted of the blacksmith and his helper, and one drill repairman—all natives, who were able with the facilities available to recondition the drill steels and to keep the drills fit for service. Air for the operation of the machinery in the blacksmith shop and for the drifters was provided by a 21&12½x14-inch PRE-2 compressor, with a piston displacement of 1,302 cubic feet of free air per minute.

As previously mentioned, Mr. G. W. Hezzlewood was in charge of construction; and no tunnel work of a similar length in Mexico has ever been carried forward so rapidly. No small part of this success was due to the air-driven equipment used on the job.

UTILIZING GAS FROM SLUDGE

Last year, the Birmingham Tame and Rea District Drainage Board—which is said to operate one of the largest sewage-disposal plants in England—decided to make use for power purposes of the gas given off by sludge, and equipped a plant with that object in view. Commenting on this installation, the *Engineer* said that results so far obtained indicate that the plant can be counted upon to produce 500,000 units of electricity annually. To meet the growing demand for power, the board is already planning to enlarge the power plant—at an expenditure of approximately $90,000—by adding a 400-hp. engine with the necessary alternator, gas collectors, etc. The yearly output, it is expected, will thus be increased by 1,000,000 units of electricity.



Hezzlewood switch which proved very effective in speeding up the work of mucking.

History of the Hecla Mine

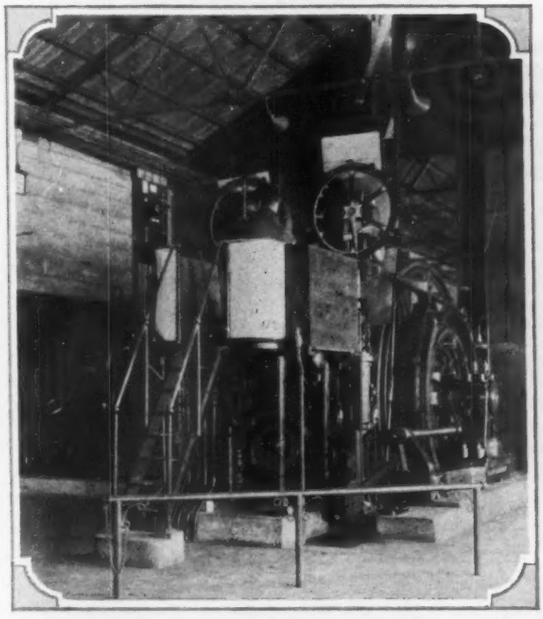
What Was Done to Restore Electric Service and to Unwater the Mine

PART III

By A. C. STEVENSON*

IT is the purpose in this installment to sketch in a general way the difficulties experienced and the various steps taken in unwatering the Hecla Mine and in replacing and in rebuilding the equipment destroyed or damaged by the fire. All the power lines as well as the mine feeder cables were out of commission. Therefore it was necessary, first of all, to set about restoring the electrical connections; and a crew was at once put to work on this job by the Washington Water Power Company. No time was lost in running about 4,000 feet of 66,000-volt transmission lines and something like 2,000 feet of 2,200-volt feeders. Just what was accomplished can, perhaps, be appreciated when it is known that current was available at the mine within 26 hours after the conflagration.

While these operations were in progress, other men were engaged in stringing temporary lighting wires and in getting transformers to the site. As a result of this co-operation it was possible to turn on the lights and to illuminate the "dump" the instant the electrical connections were established.



Electrically operated hoist at the Hecla Mine.

There was just one way of going down into the mine, and that was by foot. But before workers were permitted to enter, the mine was first thoroughly explored for gas by a group of trained helmet men accompanied by Mr. ..... Sparks of the local mine rescue squad. When these men reached the 2,000-foot level, about 45 hours after the fire, they found that the equipment on that station was submerged and that the water was 5 feet 6 inches deep. All this time surface activities were being rushed without cease in an effort to restore service underground.

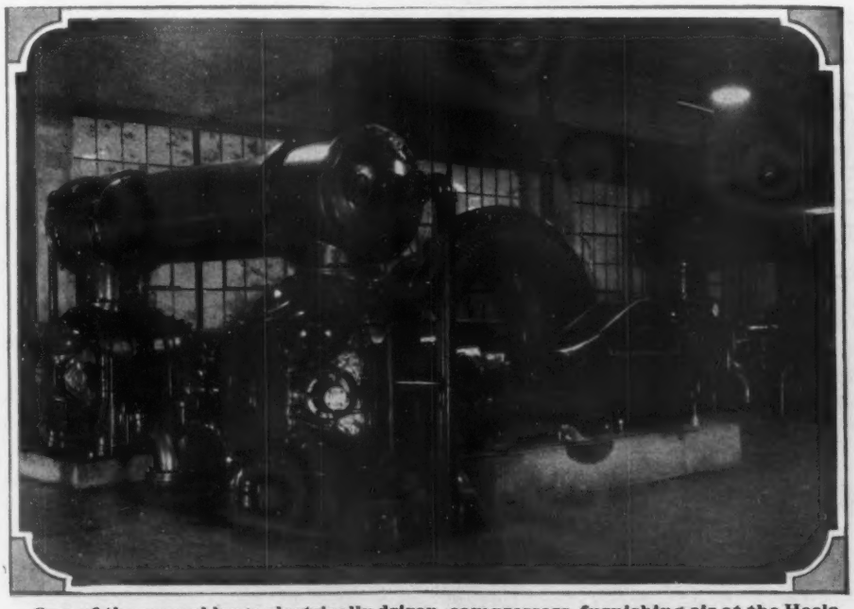
As soon as a safe entrance to the mine was assured, a crew was sent underground and put to work cutting all the feeders and signal-system cables which led to the 2,000- and to the 1,600-foot levels and connecting them to switches preparatory to the installation of pumps for the purpose of unwatering the mine. This part of the reconstruction program was completed 68 hours after the fire, when power was turned on below ground and the 1,200 pumps were started.

As all the supplies had been destroyed, the Hecla Mining Company was entirely dependent upon its neighbors for immediate relief. Mr. ..... Clark, of the Bunker Hill, promptly selected from that mine's stores a much-needed stock of supplies and dispatched them by truck to the Hecla. And, as soon as time could be spared, an inventory was taken of the secondhand machinery available at idle properties lying within close reach of Burke. Much in the way of materials and equipment, used during the first few weeks following the catastrophe, was thus borrowed and bought from other mining companies in the district.

Next, inquiries were hastened to such concerns as the Washington Water Power Company, the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Ingersoll-Rand Company, the Coeur d'Alene Hardware & Foundry Company, the Bunker Hill, etc., etc., in an effort to procure certain essential machinery from the nearest possible sources. In this manner were obtained a compressor, centrifugal pumps, motors, etc.

Immediately after the 1,200 pumps were started, and all water above the 1,600-foot level was thus held in check and prevented from speeding up the filling of the mine, then preparations were begun for the unwatering of the lower level. A 3-stage Cameron centrifugal pump—originally the Hecla Mine fire pump—was directly connected to a motor, making 1,800 revolutions per minute, that had come all the way from Schenectady, N. Y., by express. This pump, though designed to run at 1,450 revolutions a minute, was driven at as high as 1,800 revolutions, and was then said by some of the fellows on the job to be "a going hound." This unit was placed on the 1,600-foot level so as to relay the water to the sump on the 1,200-foot level.

The Ingersoll-Rand Company furnished a 500-gallon, 100-hp., Cameron pump. This pump was en route to Montana; but, through



One of the several large electrically driven compressors furnishing air at the Hecla Mine. The compressor plant has a combined capacity of 8,900 cubic feet of air per minute.

*Chief Electrician.

the courtesy of the people to whom it was consigned, it was sidetracked and redirected to Burke for use at the Hecla Mine—the company in question ordering a duplicate from the factory. Another similar unit—which had seen service as a boiler-feed pump at the Treadwell, in Alaska—was purchased from a dealer of secondhand equipment in Seattle, Wash. One of these 500-gallon pumps was installed on the 1,600-foot level to act as a stand-by for the larger unit, thus assuring uninterrupted operation in case of a breakdown.

Efforts to get an electrical sinker for placing in the shaft proved unsuccessful. All that could be had were air pumps, and four of these were obtained without difficulty. Two No. 9B Cameron sinkers were borrowed, one each, from the Tamarack Mine and from the Morning Mine, and a No. 7 Cameron was loaned by the Monarch Mine at Murray, Idaho. These, together with another No. 9B Cameron that had survived the fire, were installed in the Hecla shaft.

Courtesy, Engineering and Mining Journal

Before the fire, the surface plant of the Hecla Mining Company was composed mostly of frame buildings.

Compressed air necessary to drive these pumps was partly furnished by a 1,150-foot compressor borrowed from the Marsh Mine and partly tapped from the air line of the Hercules Mine. Inquiry revealed that there was at the plant of the Todd Ship Building Company, in Seattle, Wash., a 2,200-foot, direct-connected Ingersoll-Rand PRE-2 compressor. This was a wartime machine that had never been uncrated, and was bought and shipped without delay.

Before the preparations had been completed, the water had reached a point 65 feet above the turnsheet of the 2,000-foot station. Soon after the air pumps began handling the water it was realized that they would not do. In short, it was found that the rate of "beating" the water by this method was so slow that it would take unreasonably long to unwater the flooded area. The following procedure was finally decided upon: One of the 500-gallon units was disassembled and again set up in a raise in the mine above the 2,000-foot level. About 3,000 feet of 2,200-volt cable, sufficient to reach from this unit to the 1,600-foot level, was ordered sent by express from San Francisco. As the water receded, this pump was carried down from floor to floor until the drift was reached, when it was mounted on a truck on which it followed the water down the drift. This scheme, though difficult of accomplishment, proved successful. From that time on, until the operation was concluded, more than 2,000,000 gallons of water were pumped on an average every 24 hours.

After the 2,000-foot station had been made accessible, a dam was reared at the intersection of the Star crosscut and the Hecla drift. This was done so that the water from the Star Mine as well as that in the Hecla, exclusive of that in the shaft, would go back through the Hecla drift to the raise pump, as it was called, leaving just a pond at that station with no source of supply. This pond was quickly pumped dry, permitting the removal of the equipment on the 2,000-foot level.

An examination of the machinery, clothing, etc., that had been submerged showed that all cotton fabrics had rotted. A finger could easily be pushed through the material of the overalls, jumpers, etc., that had been left at that level. Cotton insulating on electrical equipment was in the same condition, necessitating rewinding. This situation had been anticipated by having on hand enough supplies to make the needful repairs. By rushing this part of the work it was possible to begin pumping from the 2,000-foot station with the rebuilt machinery five days after the turnsheet was reached.

As previously mentioned, all hoisting facilities had been destroyed. Just what this meant can be realized when it is understood that it took 1½ hours to get to the surface from the 1,200-foot level. For the first few days the pump men worked in relays—two men being stationed at each pumping plant for 24 hours at a stretch. This was considered preferable to wasting three hours in toilsome clambering to and from the station for every eight hours of work performed. Under the circumstances, it was imperative that a hoist be provided to carry the unwatering crews and the pumps.

Luckily, the Coeur d'Alene Hardware & Foundry Company had a 100-hp., 4,000-pound hoist that was suitable. This was ordered shipped to the Hecla Mine immediately. No attempt was made at that time to erect a gallows frame, only the debris was cleared away sufficiently for a setting. Timbers were laid across the collar of the shaft, and a sheave placed upon them—access being had to a cage at "Chinatown", an opening about 30 feet below the collar of the shaft. There was in stock at the Hecla a hoist that was not unlike the one just mentioned. This was sent to the Coeur d'Alene Hardware & Foundry Company's machine shop for rebuilding; set up in the foregoing manner upon completion; and used in the other shaft compartment. By this arrangement, one or the other of the two hoists was always available during the reconstruction period. Changes to higher sheaves and different settings were effected without interruption.

With the transportation problem thus temporarily solved, attention was next turned to the replacement of the main hoist. Notices to builders of hoisting and electrical equipment brought out the information that delivery could not be promised much before a year or eighteen months after the receipt of the order, and attempts to find a satisfactory secondhand hoist met with no better results. The Wellman-Seaver Morgan Company agreed to supply a duplicate of the hoist that was burned within 90 days, provided a bonus was paid for overtime; but the Westinghouse Electric & Manufacturing Company would not even consider reproducing the electrical equipment—thus necessitating the rebuilding of that part of the hoist. This was done successfully—the motor being sent to Seattle and the other accessories being taken care of on the spot.

Soon after the conflagration a drying oven was designed and ordered made. For this oven secondhand heaters were obtained at Northport, Wash. This apparatus has returned the original cost price many times over in restoring for re-use water-logged materials and equipment. All but the 2,200-volt motors were thus dried; and six out of eight transformers, as well as four entire locomotives, were in this way made fit again for service.

The main feeder cables leading down the shaft and the feeder cables extending upward and outward from the 2,000-foot station were found to be full of water even though the ends, in all cases, had been fitted with approved

types of pot heads sealed with a filling compound. Anyone familiar with the construction of electric cables knows that no one method can be counted upon to get rid of water from between the copper strands and the layers of varnished cambric surrounding them. It was deemed justifiable, on account of the great quantity of cable in this condition, to go to considerable expense to reclaim it. To do this, the following plan was conceived. About 500 feet of cable, at a time, was wound on a reel and placed in the drying oven. One end of this cable was attached and sealed to the intake of a vacuum pump rigged up from an old ice machine. While the cable in the oven was thus being subjected to a temperature of about 160°F., the vacuum pump was set to work to speed up the drying operation—drawing off the vapor induced by the heat. Each one of these 500-foot lengths was dried out in fine shape in approximately 70 hours. This experience has suggested that it might be good practice to impregnate electric cables intended for underground use with some sort of plastic insulating compound which is waterproof. Besides overhauling the cables, it was also necessary with sandpaper to go over every foot of trolley wire leading into the Star crosscut before it could be utilized again.

Of the Edison storage batteries which were on the 2,000-foot level about 30 per cent had sealed themselves and were found to be intact; 50 per cent were full of mine water and required only washing out and renewing of the electrolyte; and the remainder, which had leaky containers, had to be shipped to Seattle for recanning.

Much of the electrical equipment at the Hecla Mine, today, is either secondhand or rebuilt; and, since its installation, has operated to the management's entire satisfaction and, no doubt, will continue to do so. Aside from its lower cost, as compared with new machinery, it was generally ready for immediate delivery, and that was the deciding factor.

Reference was made previously to the listing by the Hecla Mining Company of secondhand equipment at near-by idle properties and in the hands of dealers. Experience has taught that company that such lists, which are sent out regularly by those in the business, are of considerable importance in the event of an emergency, and should be available for ready reference. The value of knowing at a moment's notice just where certain parts, machinery, etc., are to be had cannot be overestimated, and may make all the difference—even in the case of only a breakdown—between a few days' delay and a complete shutdown over a protracted period.

Courtesy, Engineering and Mining Journal

The way the surface plant of the Hecla Mining Company appeared after its reconstruction. Concrete was used for these structures.

WATER-POWER DEVELOPMENT IN PORTO RICO

WORK is to begin shortly, according to *Commerce Reports*, on the Rio Blanco power project in Porto Rico. The plan provides for the utilization of the water of four streams which, coming together at about the same place, form the Rio Blanco in the Luquillo Mountains, in the eastern part of the island. A map of the district shows these streams reaching out toward their sources like the fingers of an outspread hand.

A pipe line, describing an arc that intersects each of these streams at right angles to its flow, will collect and carry the waters to a reservoir, whence they will drop through a penstock to the Rio Blanco. This pipe line will be about 14,000 feet long and 42 inches in diameter at its lower end—diminishing in size as it ascends. Much of the pipe line will require tunneling, and the penstock will pierce 1,370 feet of solid rock. The cost of the project is estimated at $800,000.

COMPRESSED AIR FOR BLOWING SOOT

A SOOT-BLOWING system, that is operated with compressed air instead of steam, has been in use now for a year and more in the Columbia Station, Cincinnati, Ohio, of the Columbia Power Company, and has proved the worth of compressed air in this field of service. While the "results obtained should not lead one to accept this scheme as a sort of panacea for all soot-blower troubles"—writes Jos. H. Heimbrock, chief engineer of the Columbia Station, in *Power Plant Engineering*, "air for soot blowing has been satisfactory at the Columbia Station. Exit gas temperature of 285° at the stack, for an average of twenty months, is sufficient evidence that the soot blowers have done their job well in keeping both the boilers and the economizers clean."

Continuing, Mr. Heimbrock says: "Air demands for other purposes, such as in the pulverizer or coal-preparation house, for general plant use, and the like, justified the installation of a 1,130-cubic-foot air compressor with the usual spare. This gave an ample amount of air for the blowing of soot. To insure the maintenance of pressure even with long-continued blowing, large air receivers were provided."

During a normal working day, about 680,400 cubic feet of air is required daily for cleaning the boilers and associate economizers, of which there are eight in the plant; and the average monthly operating and maintenance cost for this service, over a period of thirteen months, has amounted to $243.62.

GOVERNMENT TO BUILD NEW HELIUM PLANT

UNDER the terms of a contract with the Amarillo Oil Company, of Amarillo, Tex., the United States Bureau of Mines will undertake the extraction of helium from natural gas from that company's leases on the Cliffside structure in Potter County, Tex. Helium, as most of us are aware, is a noninflammable gas used principally in the operation of Government dirigibles, and is therefore an important factor in national defense. Preparations are now being made, says *Gas Age-Record*, for the erection of a helium plant near Amarillo.

The helium will be recovered by cooling the gas to approximately 300° F. below zero, at which temperature all the constituents of the gas, except the helium, are reduced to a liquid state. The helium will then be drawn off as a gas and subsequently compressed and charged into steel cylinders for shipment. The remaining liquid, consisting of the original gas minus the helium, will then be evaporated to the gaseous state by allowing its temperature to return to normal, and will be delivered into the company's gas lines for use in Amarillo as fuel. The heating value of the natural gas is improved by the extraction of the helium, because the helium and other inert gases to be removed have no fuel value.

RECLAIMING IRON FROM BEACH SANDS

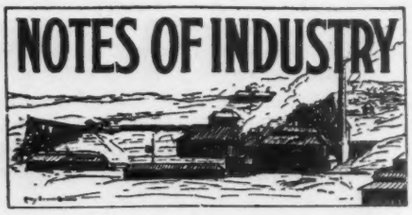
THERE has recently been put in operation, at the Kuji Iron Works, a process that has been developed especially for the purpose of utilizing the vast deposits of ferrous beach sands near Kuji, Japan, situated on the northeastern coast of the Island of Honshu. These sands are about 70 miles in extent, and have an average thickness of 18 feet. It has been conservatively estimated that the beds contain a minimum reserve of 200,000,000 tons of ore.

By the process, the common oxides of iron —hematite, limonite, magnetite, and residues from the roasting of iron pyrites—are reduced at a temperature ranging between 932 and 1,832°F., which is sufficiently low to prevent the melting of the iron or other mineral constituents in the ore. No flux is used. At present two furnaces have been installed in the Kuji Iron Works for the treatment of the sands, and each of these furnaces has an output of 50 tons of sponge iron in 24 hours.

According to the *Far Eastern Review*, the beach sand is charged continuously through pipes to an annular hearth or sponge-iron furnace—coal, which has been partially distilled to drive off moisture and light volatiles, being fed with the sand in the approximate proportions of 1 part of coal to 4 parts of sand. The annular hearth rotates slowly, and heat is applied from 72 carborundum tubes placed immediately above each hearth. Gas is burned in these tubes; but as the waste gases do not mix with those formed over the rotating hearth there is no danger of oxidation of the particles of iron after they have once been reduced to the metallic state.

The rotating hearth is 12 feet wide. As the ore and the coal pass across the hearth they are mixed, and the iron oxide is reduced to metallic iron. This takes about 30 minutes. The finely divided metallic iron, together with the waste material in the original beach sand and the excess coal, is discharged continuously into cylinders that revolve in water to cool the material to atmospheric temperature. This is necessary in order to prevent the sponge iron from burning back to iron oxide, which would occur if the temperature of discharge were too high. This cooled material is then passed over magnetic separators, where the metallic iron and a certain proportion of ilmenite are separated from the waste material. The ilmenite lowers the grade of the iron somewhat; but there is no particular disadvantage in this other than that the ilmenite must be charged into the melting furnaces later.

The sponge iron is next briquetted in special presses operating at from 40,000 to 50,000 pounds pressure per square inch. These briquettes have a density of about 75 per cent of that of solid iron, permitting them to be charged directly into open-hearth furnaces and insuring their sinking below the slag line. The result is a very pure wrought iron with no combined carbon present and without combinations of phosphorus or titanium.



The 60-mile Main Reef Road, connecting the gold mines on the famous Rand, in South Africa, is to be transformed into a thoroughly modern highway.

It is reported that at least 85 per cent of the coal produced in the Ruhr district, Germany, is now mined with either pneumatic or other coal-cutting machines.

In his last annual report to the Secretary of the Interior, the Governor of Alaska stresses the services rendered by aviation companies in the development of the territory. Three commercial aviation companies, operating eight planes, are now engaged there in carrying passengers and freight to hunting lodges, trappers' runs, isolated villages, and mines located at remote points accessible heretofore only by dog sled. To encourage this enterprise, the Territorial Legislature some time past authorized the expenditure of $40,000 for suitable flying fields, with the result that Alaska now boasts 44 of them, varying in size from 300x800 feet to 600x1,400 feet.

In 1927 the railroads of the United States received an average of 1.08 cents for moving a ton of freight one mile. This represents a decrease of 15.3 per cent as compared with the cost for this service in 1921.

The Fifth World Motor-Transport Congress is to be held this year in Rome, Italy, from September 25 to 29.

Sweden's iron-ore fields, which were worked as far back as the thirteenth century, are estimated still to contain more than 275,500,000 tons of high-grade ore.

About 50 per cent of all the lead produced in Europe comes from Spanish mines, which have an annual output of more than 200,000 tons.

Private enterprise, organized in Germany for the economical utilization of coal, has proposed to supply the Province of Westphalia, exclusive of the Ruhr District, with gas produced right at the pit mouth.

The Meteorological Service of Canada has just established a new weather bureau at the St. Hubert Aerodrome, near Montreal, Que., that is completely equipped with every modern facility to aid aerial navigation. This station has been provided in preparation for the transatlantic airship service to be inaugurated this coming summer between England and Canada.

The monetary needs of the people of the United States are now served by 27,529 banks.

Work on the 2-mile bridge that is to span Sydney Harbor is well underway, and the prospects are that the structure will be open to traffic late in 1929.

Helium gas has been discovered near Frankfort, Germany, it is reported by the American Consul stationed in that city. The find, which is said to be the first of its kind in Europe, was made while sinking deep wells for water.

The United States produces and consumes annually about 350,000,000 gallons of ice cream.

Approximately 1,000,000,000,000 cubic feet of manufactured gas is consumed annually in the principal countries of the world. Last year the United States alone used 475,000,000,000 cubic feet—or almost half of that total, besides about 1,340,000,000,000 cubic feet of natural gas.

At an estimated cost of $12,000,000, according to *Commerce Reports*, the Brazilian Government has undertaken to straighten and to canalize the Tiete River which winds its way through the City of Sao Paulo.

A comprehensive road improvement and construction program has been formulated by Japan that will require ten years for its completion. More than 3,600 miles of roadways throughout Japan are to be modernized.

Air spaces built into the walls of boilers, furnaces, etc., do not fulfill their designed function at high temperatures, say Messrs. Ray and Kreisinger, of the United States Bureau of Mines. As the result of an exhaustive series of tests, with air spaces serving as insulation, it was established that the hot surfaces radiate heat so rapidly that a greater amount of heat is lost across the air space by radiation than would be conducted if the space were filled with material of relatively high conductivity, such as fire brick. Besides the intense radiation there is also rapid convection. The average velocity of the molecules of the air, at 1,100°F., is approximately 60 miles a minute. The term "dead air space", as it is sometimes called in this connection, is, therefore, a misnomer: more properly it should be spoken of as "live air space".

Germany has recently opened the doors, in Berlin, of a permanent engineering exhibit—known as the *Haus der Technik*—where her manufacturers of tools, machinery, electrical equipment, etc., may display their products the year round for the convenience of students, buyers, and others interested in this field of effort.

Java, with 730 people to the square mile, is said to be the most densely populated area in the world.

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—Founded 1896—

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EDITORIALS

AMERICAN HENS PRODUCE GREAT WEALTH

AMAZING as it may seem, the American Road Builders' Association has recently broadcasted the following news item: "Statements from leading egg markets of the country—including Chicago, Boston, Philadelphia, and Indianapolis—show a remarkable increase in egg production during the first few months of 1927. The total value of eggs marketed during the year is expected to surpass the entire output of the gold-and-silver industry for the same period." If this be true, then the hens of the country laid eggs worth $79,684,938. Now we know what the industrious biddies are doing to make it possible for us to have "ham and' " whenever and wherever we wish.

But why, the Doubting Thomas will ask, "Should our hens be more productive than our mines of precious metal?" Here is where science is joining hands with the farmer—at least, that is one explanation. We are told that the hen is no longer left to her own unaided initiative in laying eggs. Where she might normally lay only three eggs a week, she is now induced to double that output at certain periods of the year. This is done by exposing her to artificial light when the sun is hidden and by bathing her in the stimulating rays of the ultra-violet lamp. Somehow, the ultra-violet rays make her more anxious to produce eggs, and the artificial light fools her into believing that she is facing another day when in fact she is still contending with the same old 24 hours. Furthermore, ultra-violet rays make short work of irritating vermin, and the hen is not obliged to seek relief by wallowing in a bed of dust—she can remain comfortably on the nest in pleased contemplation of her well-arranged feathers and just continue to lay, lay, lay—anyway, that is the intention of the new hen-house regime.

What a boon it would be if the same energizing rays could be turned upon other paths of life! We have a few in mind, but we won't mention them.

ANOTHER DEEP-ROCK TUNNEL FOR NEW YORK CITY

LOOKING to the future, and intent upon filling its cup to overflowing, the City of Greater New York has authorized the driving of a tunnel, 17 feet in diameter, through rock 500 feet below sea level. This aqueduct, which will be somewhat more than twenty miles in length, will entail a total outlay of $64,000,000. This figure is illustrative of the difference in cost between a deep-rock tunnel and a traffic subway lying but a comparatively few feet beneath street levels.

In round figures, the aqueduct will involve an average expenditure of $3,000,000 a mile, while some sections of Manhattan's newest subway impose an outlay of $12,000,000 a mile. Offhand, this disparity may be hard to understand, especially when we are reminded that it will be necessary to sink no fewer than nineteen shafts in order to reach as many points along the line of the tunnel so that headings can be driven in two directions from each of them for the purpose of speeding operations. In other words, thousands of feet of shafts will be sunk in addition to excavating the tunnel, itself.

The real explanation of the difference in cost lies in the fact that surface disturbances of property will occur only infrequently; water mains, gas pipes, sewers, and electric and power conduits need not be moved; nor will more or less expensive underpinning of adjacent or overlying buildings have to be resorted to. The tunnel drivers will work so far beneath the arteries of traffic that but few of the passing public will be aware of what is going on hundreds of feet below; and the rock drills will penetrate the solid ledge in breaking a way for the conduit that is to bring millions of gallons of water from distant mountains to the various boroughs of the metropolis.

Not only will the tunnel driver have the physical advantage of a superior geological formation in which to do his work, but the city will find it less costly when it comes to the question of obtaining easements for the tunnel right of way. In the case of the first water-supply tunnel that is now serving Greater New York, the average easement called for the payment of a trifle more than two dollars a foot.

In part, the purpose of the new deep-rock aqueduct, which will connect with the existing one, is to provide a loop through a populous section of the city—this loop to be used independently, if need be, to supply the community with water when a section of the existing tunnel is cut off for one reason or another. This splendid project offers another opportunity for the pneumatic rock drill and for the air compressor to show what they can do in carrying out a vast engineering work that has for its final aim the well-being of millions of people.

OUR CHEMICALS NOW BOUGHT BY WHOLE WORLD

WITH the exceptions of Greenland and Italian Africa, the United States, in 1927, sold chemicals and allied products to every country of the world. What is equally to the point, the value of those exports totaled $184,134,000.

This evidence of the expansion of America's chemical industry should bring to the nation at large a feeling not only of satisfaction but pardonable pride, especially if the people recall how dependent we were prior to 1914 upon European producers for the vast bulk of our primary chemicals as well as allied chemical products. The World War brought home to us the realization of our own deficiencies in this vitally important department of industrial life; and, thanks to that rude awakening, we have since energetically pursued a course calculated to place us in a position of comparative self-sufficiency. We could not afford to export $184,000,000 worth of chemicals until we had taken care of our own needs.

Perhaps the most significant change in this business is that Europe continues to be the best market for American chemicals. Germany, in particular, is buying more from us than ever before, and Great Britain purchased fully 15 per cent of all our chemicals exported—that is, she bought $28,200,000 worth.

KIND WORDS FROM THE VISITOR

NOT long ago, Prof. WALTER GROPIUS, the founder of the well-known school of architecture and allied arts in Dessau, Germany, sailed for home after nearly two months spent in the United States. He had come to this country for the special purpose of studying our methods of mass production and their relation to time-saving. This eminent man has sought here a solution of one of Germany's pressing social problems—the erection of more than 1,000,000 dwellings to take care of the nation's shortage of houses.

Before leaving our shores, Professor GROPIUS said, so the *New York Times* reported, "You can build a house as cheaply here as one can in Germany even though your workmen are paid about four times as much, simply because your technical methods enable them to make much more efficient use of their time." Mass production is to be utilized by Professor GROPIUS in dealing with the situation in Germany; and his countrymen will thus benefit by practices that we have developed.

According to Prof. ANDRE SIEGFRIED, of the French School of Political Sciences, "The greatest contribution of the United States to the civilized world has been the conquest of the material dignity of life." As he expressed it, America "has created a new civilization based upon a new conception of production and business." Mass production, as he viewed it, is a new conception of material life; and as a consequence of this the United States is far more independent of Europe than

it was 30 years ago—in short, it is self-sufficient to a degree far in advance of conditions three decades back when her cultural standards were based upon those of Europe.

Again, to quote from the *New York Times*, Professor SIEGFRIED stated that "In reward for her labor, energy, and intelligence, America has reached a level of human practical life that Europe has not realized. Europe is very much behind America in machinery. America has taught the Old World what use can be made of machinery. America has realized what the Germans call rationalism."

Perhaps we do not measure up to all standards of human excellence that some theorists prescribe; but it is gratifying to know that we have achieved some things that warrant the approbation of competent critics abroad. Possibly, when more of these students know us better they may see even greater good in what we do and in the way we do it.

MIDDLE AGED AT EIGHTY

WHILE the majority of us would, undoubtedly, be content with the biblical mortal span of three score and ten years, still we cannot be indifferent to the pronouncement of Dr. SERGE VORONOFF, who has lately declared that there is no physical reason why we should not last until we have rounded out a century and a half. If this exponent of transplanted monkey glands and rejuvenation cannot promise us a lightening of life's vexations with increased longevity, it is debatable whether many of us would care to profit by the treatment that he has to offer—especially if we were to become merely "venerable vegetables". After all, the value of added years lies, in a social sense, in what one does with those years in contributing to the welfare of one's fellows.

According to a dispatch in the *New York Times*, Doctor VORONOFF is said to have told a group of women: "There is no reason why you should not live to be 140 or 150 years old." We just naturally wonder how this well-known member of the medical fraternity had the temerity to tell any gathering of women that they could ever reach maturity of such amazing proportions, especially when he admitted that French women, for example, sought but to retain their beauty and, inferentially, to be only as old as they looked.

Work is soon to be started on the Island of Mindanao on one of the largest road-construction projects in the Philippines. The highway will have a length of approximately 108 miles, exclusive of bridges, and will extend from Illana Bay, on the west, to Davao Gulf, on the southeast—passing through rich agricultural lands that are to be opened to settlement as soon as this road is completed.

It is reported that a sum of about $2,000,000 is to be spent in developing potash deposits situated ten miles south of Odessa, in Ector County, Tex. The associate refinery to be built there is to be ready for operation by June of next year.

THE GLANDS OF DESTINY, by Ivo Geikie Cobb, M.D. A book of 295 pages, published by The Macmillan Company, New York City. Price, $3.00.

THE subhead of the title describes the volume as *A Study of the Personality;* and Doctor Cobb has sought to make it clear to the layman that the chemical reactions set up in our bodies by a group of ductless glands have a direct and a very important effect upon those characteristics that are usually summed up in the comprehensive term, "personality". This work is one more contribution to a subject that has engaged the attention of the medical fraternity increasingly in latter years—a subject that but a comparatively short while ago was considered by physiologists as of little significance. Some eminent authors then referred to these glands as nothing more than vestiges of anatomical conditions that prevailed eons ago when we had other forms and radically different habits of life.

Doctor Cobb is an eminent English neurologist, and, therefore, what he says should have the weight due to the opinions of an expert. One by one, he discusses each of the different ductless glands and tells in understandable terms what it does and also how they interact. It is not hard to grasp, after reading the book, how the personality of an individual may be greatly influenced by the correct or the imperfect functioning of one or more of these glands. Conversely, it is evident that functional irregularity may be reduced or neutralized in many instances by appropriate treatment.

POWER CONTROL, by H. S. Raushenbush and Harry W. Laidler. A work of 298 pages, published by New Republic, Inc., New York City. Price, $1.00.

IT will be recalled that one of the legal officers of the United States Government compiled a report about fifteen years ago dealing with the nation's developed and potential hydro-electric resources; and the primary purpose of that report was to disclose the interlocking relations of large enterprises engaged in this particular field of public service. The citizenry were left to infer that the interlocking or interdependence of these power interests had in it an element of danger to the people at large.

The present work may correctly be said to be a representation of this angle of the problem; and the authors have prepared an extremely absorbing and thoughtful exposition of this really vital matter. They make it clear how increasingly dependent all of us are becoming upon purchased power through the varied uses to which we put energy in the form of electricity. The story is a fascinating one of the latter-day development of our social life. Manifestly, it is not wise to have the control of the sources and the distribution of this power in a single group or in several groups that are noncompetitive by reason of too close a community of interest. The book contains much food for thought.

YELLOW GOLD OF CRIPPLE CREEK, by Harry J. Newton. An illustrated book of 128 pages, published by the Newton Publishing Company, Denver, Colo. Price, cloth-bound, $1.50.

THIS is really a compilation of romances and anecdotes of the mines and the mining men that have made Cripple Creek notable the world over. We believe that it will be welcomed by a large circle of readers; and we, ourselves, have found much in it to entertain, to amuse, and to instruct us.

CROWELL'S DICTIONARY OF ENGLISH GRAMMAR AND HANDBOOK OF AMERICAN USAGE, by Maurice H. Weseen, Associate Professor of English in the University of Nebraska. A volume of 703 pages, published by Thomas Y. Crowell Company, New York City. Price $4.50.

AS can be seen, the object of this excellent work is to furnish a guide to Americans intent upon using English grammar more or less adapted to the spirit of the speech of the nation. It is one further evidence that the English language is not a hard-and-fast instrument of expression but, rather, a flexible medium wherewith to convey thought correctly by either the written or the spoken word. Language, in its idiomatic form, varies with time and with the social changes of a people; but the fundamentals of a language remain for the most part constant. The author makes clear how far we can depart from the mother tongue, under American influence, without violating the hereditary principles of English grammar; and he has also given us much general guidance in the proper use of the language as it is employed by the best writers and speakers on both sides of the Atlantic.

American Gas Catalog for 1927, published by the American Gas Journal, 53 Park Place, New York City. No gas man or gas engineer should be without this excellent handbook containing a wide range of just that kind of information that the practical man so often needs. Price, $2.50.

Glass Factory Year Book and Directory, 1927 edition. A handy compendium for the glass-factory executive and for the finisher or the distributor of glass products. Published by the American Glass Review, Pittsburgh, Pa. Price, $3.00.

Staynew Filter Corporation of Rochester, N. Y., has recently issued a new catalogue that describes, among other products, two new filters made by it. This will probably be of interest to a goodly number of our readers.

Utah, America's Great Mining and Smelting Center, is the title of an illustrated brochure issued under the supervision of the Mining Committee of the Chamber of Commerce, Salt Lake City, Utah. The booklet is well written, timely, and a convincing exposition of Utah's mineral wealth and her position in the metallurgical industry of America.

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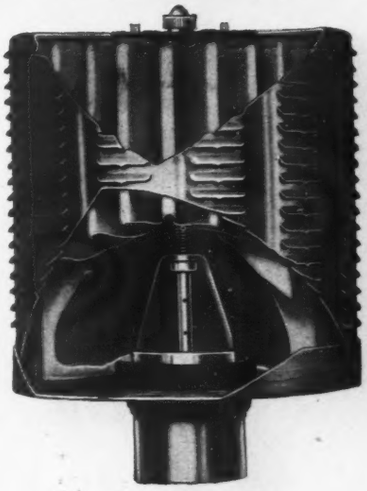

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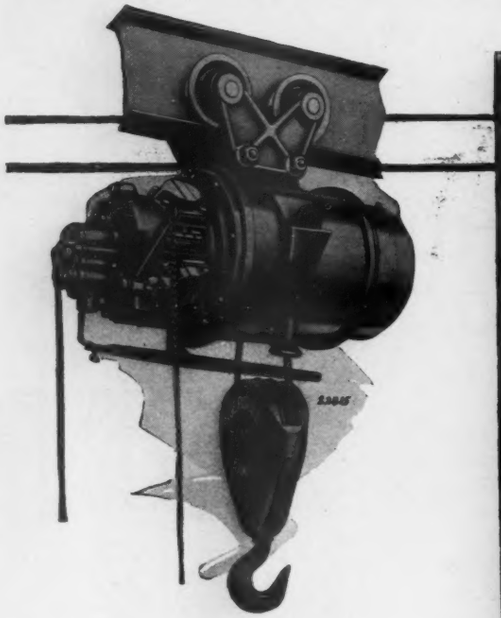

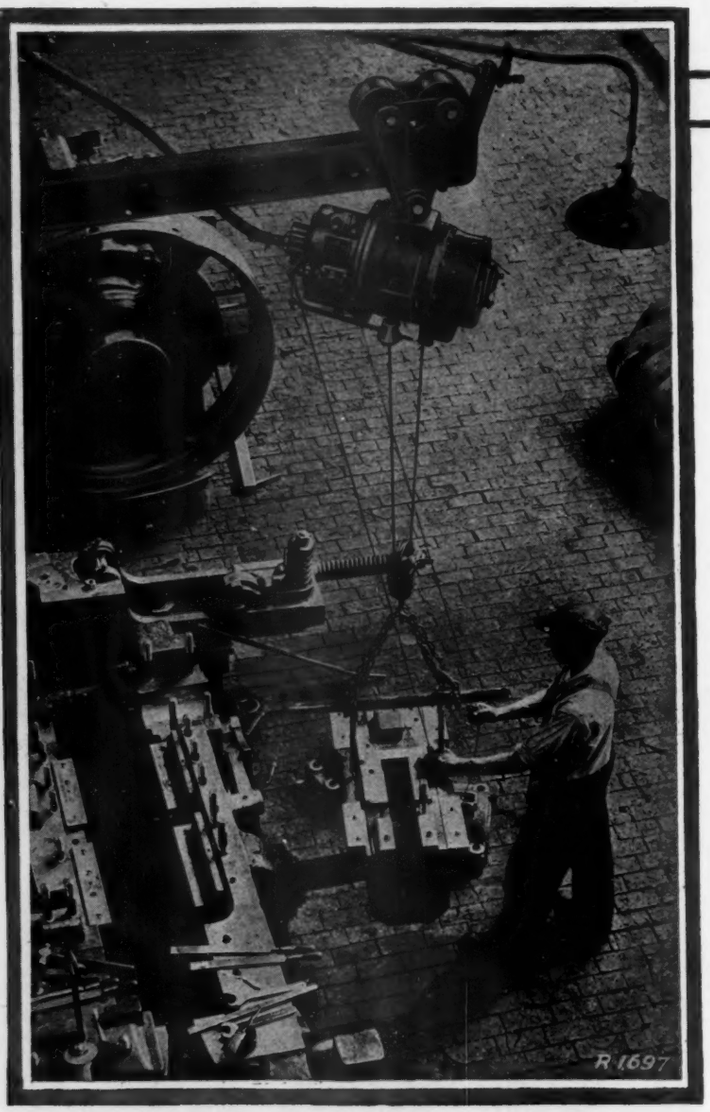

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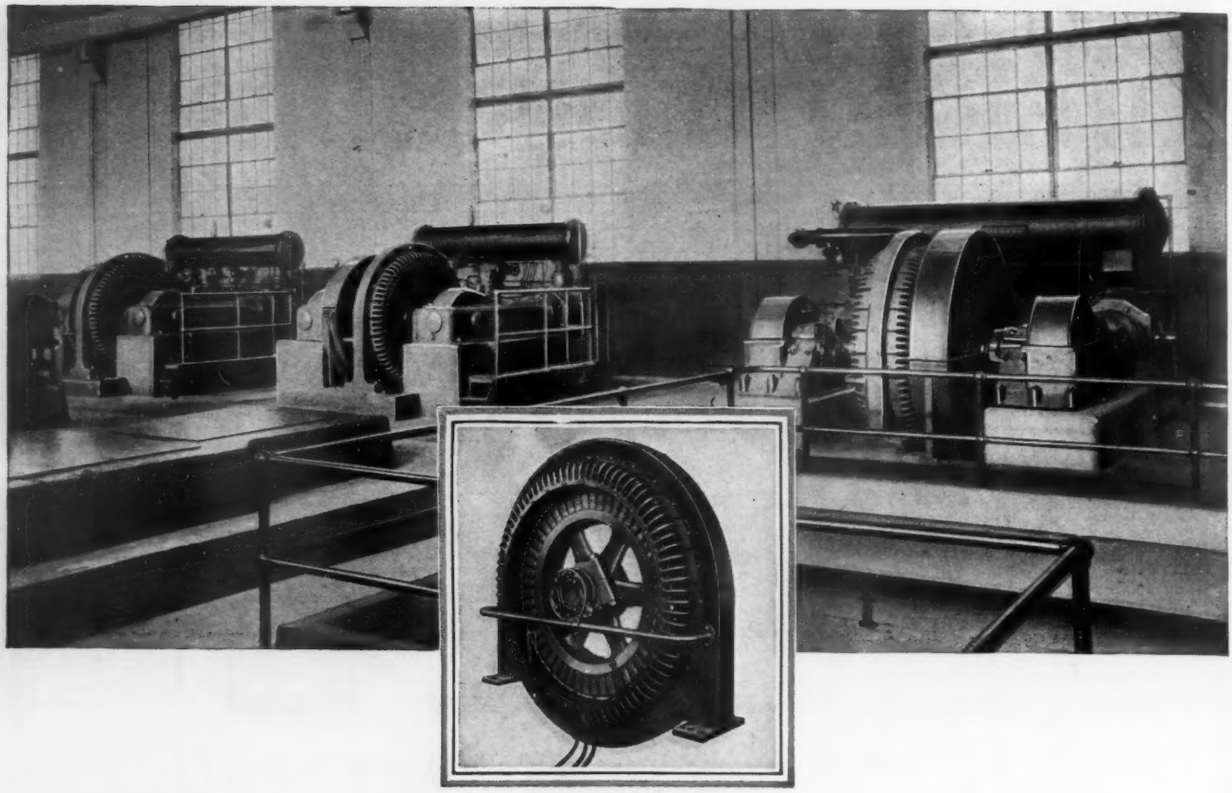

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NOTE—For subscription terms see first editorial page

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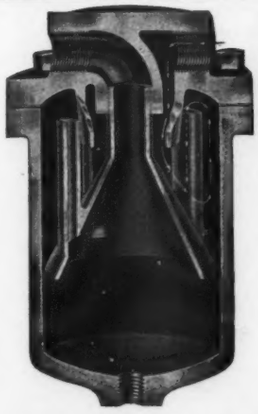

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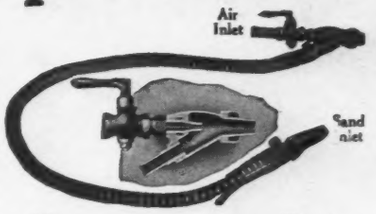

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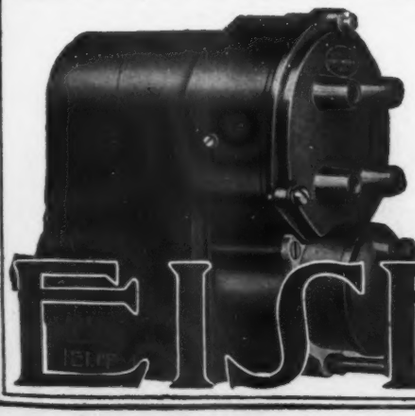

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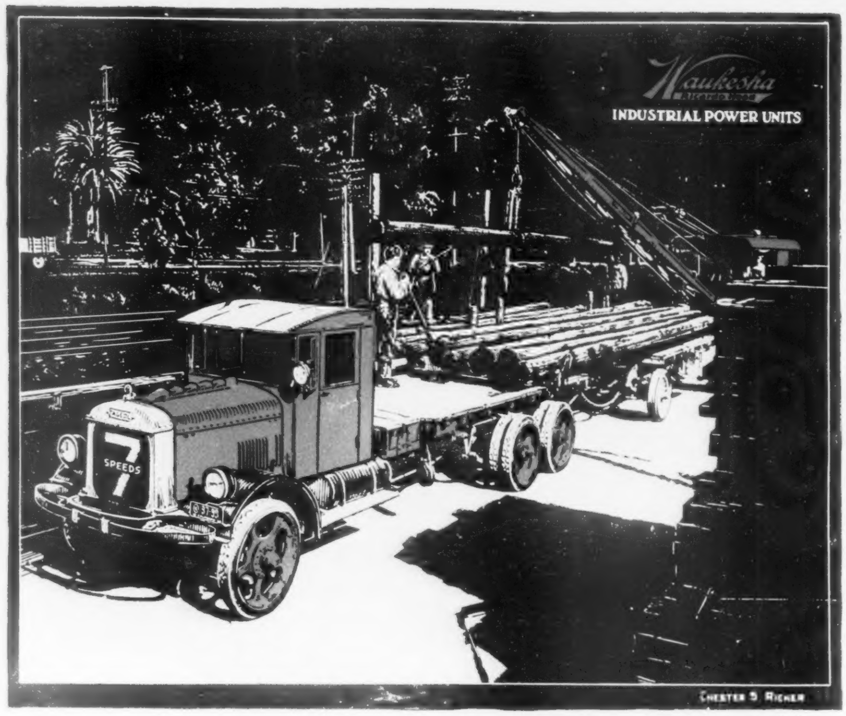

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